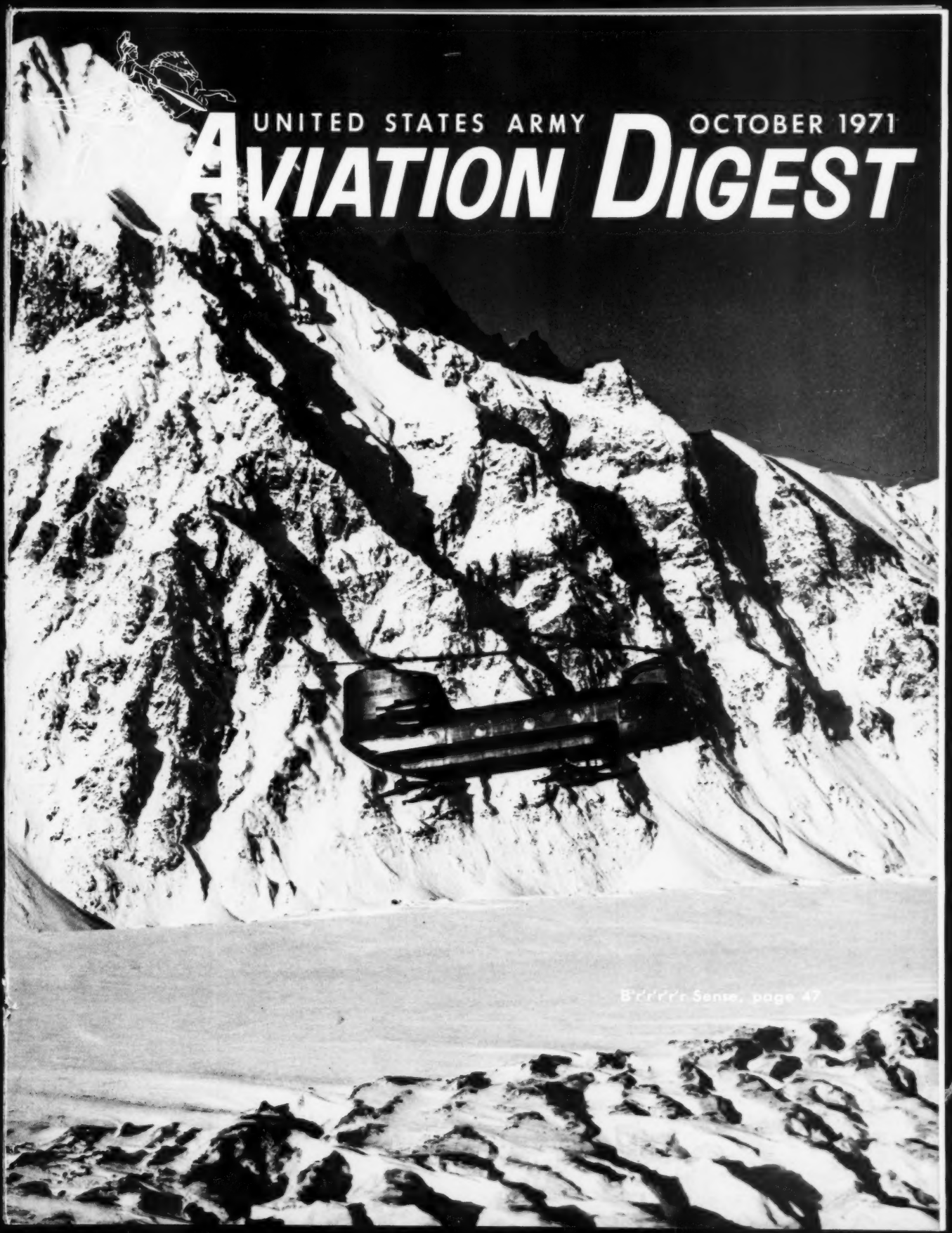
UNITED STATES ARMY OCTOBER 1971

AVIATION DIGEST



B-r-r-r-r Sense, page 47

UNITED STATES ARMY AVIATION DIGEST

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ABOUT THE COVER

A CH-47 Chinook hovers out-of-ground effect over the Susitna Glacier at the 7,500-foot level of Alaska range. An article on cold weather flying appears on page 47

The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine, and other related data.

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WEAR 'EM BUT?

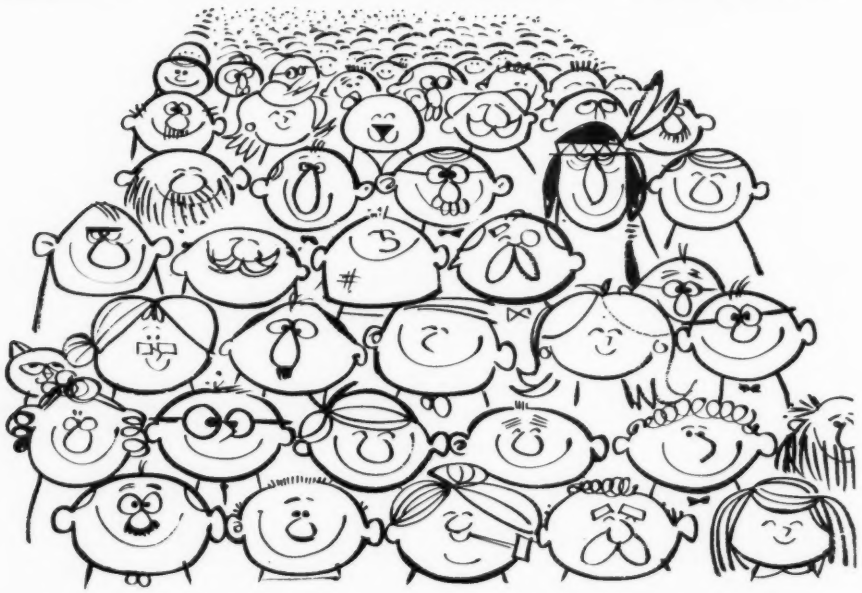
?

NONE of these examples provide the protection designed into the SPH-4

ARE YOU a thoughtless or indifferent air crewman . . .

?

LET'S KEEP OUR HEADS



Since the SPH-4 helmet has been issued, a number of air crewmen have been seen using *chin pads*. Some men get along fine without one, but continue searching under the misconception that they have been gypped. THE SPH-4 HELMET WAS DESIGNED TO BE WORN *WITHOUT* A CHIN PAD. So, take the pads off or stop searching

WARNING! The use of a chin pad with the SPH-4 helmet will greatly decrease the likelihood that the helmet will be retained during a crash sequence. Even with a snug chin strap, the pad will become compressed permitting sufficient space for the helmet to slide off the head. No helmet—no head protection!

WARNING! The SPH-4 helmet will not stay on your head unless the chin strap is snapped shut and chinched snugly. A little slack will permit the helmet just enough room to slide off your head. There is seldom time to accomplish chin strap tightening during an aircraft emergency. Without a helmet the human skull has the survival potential of a watermelon in an elephant burial ground

It may be YOUR head, but it's another experienced and valued air crewman to Army aviation. Don't just think of yourself

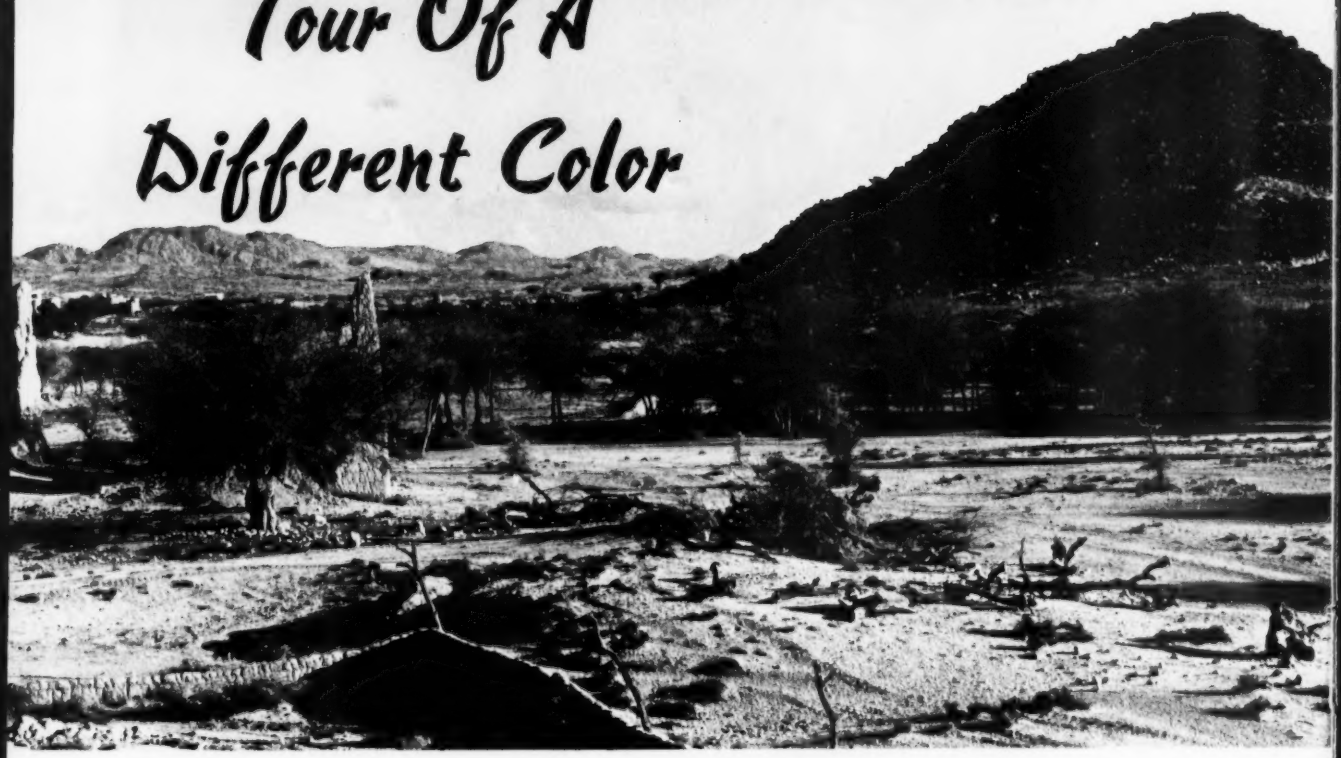
WEAR 'EM RIGHT

- Do NOT Use A Chin Pad
- Keep Chin Strap Cinched Snugly

A little mild discomfort may be the difference between life and maiming, misery or death

Provided by the Society of U. S. Army Flight Surgeons

Tour Of A Different Color



Watching a sandstorm approach is reminiscent of fog rolling in off the bay at Monterey, Calif., except it's brown, accompanied by strong winds

Captain George D. Burdette

BACK IN LATE 1968 a student Army aviator normally assumed that upon graduation from flight school he would be off to the Republic of Vietnam after a short leave period. And, this was true in most cases. Unless you graduated tops in your class there wasn't much chance of obwining a transition. Shortly after graduation I decided to call Office of Personnel Operations (OPO). The branch assignments officer had allocations for an OV-1 pilot to Vietnam and two U-8D assignments to Saudi Arabia. He said I should state my preference now or forever hold my peace. I chose the tour to Saudi Arabia.

The other U-8D position was given to an officer who was graduated one class ahead of me. The Saudi Arabian assignment was a 1 year unaccompanied tour.

We both were assigned to the U. S. Army Engineer Mediterranean Division (Headquarters in Italy), with our duty station being the U. S. Army Engineer District, Riyadh, Saudi Arabia. Within Saudi Arabia the Corps of Engineers was conducting military construction projects, establishing a television system, performing civilian-type construction within cities and instituting a logistics program. Our job was to fly the three U-8D aircraft based there in support of the engineer district.

When we arrived in Riyadh we found the aviation office consisting of one major, two civilian pilots, two enlisted mechanics, three U-8D aircraft and a 6-month stock level of spare parts.

Right, city of Abha, Saudi Arabia

Shortly thereafter the two civilian positions were abolished (present strength is three aviators and three mechanics). Maintaining a 6-month stock level of spare parts was necessary because of the remote location and the subsequent time factor in spare parts delivery. Our primary duty was flying but there also were the usual additional duties of maintenance, supply, safety and operations.

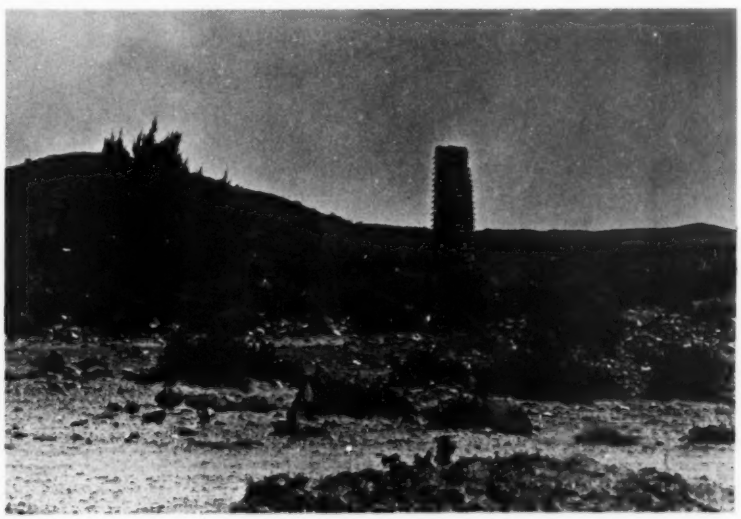
We flew to seven major field sites, which have since been reduced to five. The average flight time was 3 hours one way; the shortest trip to a major site being to Dhahran—1 hour and 15 minutes; the longest ride—600 nautical miles to remote Tabuk—took 4 hours.

Our mission was to carry personnel and light cargo and usually included an RON (remain overnight) at our destination, the return trip being the following morning. Some missions required more than one aircraft with several layovers and perhaps an RON at each destination. This was common with visiting VIPs or inspection teams.

Saudi Arabia is roughly twice the size of Texas, and occupies about two-thirds of the Arabian Peninsula. The terrain, generally, is very similar to that of the southwest United States. Some Saudi rock formations are like those found in the Grand Canyon; the desert areas (most of the country) compare with California's Death Valley. One region in the southeast, the Rub' al Khali (the Empty Quarter), is a vast wasteland of sand dunes stretching as far as the eye can see. The Nomadic Bedouins do not even live in this part of the country. Other examples of rugged terrain lie to the southwest—the field sites of Khamis Mushayt and Jizan.

Khamis and Jizan are about 30 minutes flying time from each other. However the field elevation is 6,500 feet at Khamis, but only 3 feet at Jizan. Between them lies mountain range of 10,000 feet. Following takeoff from Khamis we would continue to climb several minutes before crossing the mountains. Then it was only a short 20-minute ride from 10,000 feet to almost sea level. (The work at Jizan has recently been completed, eliminating further flights.)

A large mountainous escarpment running the length of the west coast dominates the extreme western edge of Saudi Arabia. [An escarpment is a steep slope separating two comparatively level surfaces, and results from faulting or erosion.] Elevation varies from 2,000 to 10,000 feet, but generally averages 5,000 to 7,000 feet. This



Lookout tower in southwest Arabia

escarpment slopes eastward toward the interior of the country, much the same way the Rocky Mountains slope toward the Great Plains of the Midwest. Near the capital city of Riyadh in central Saudi Arabia lies a second, smaller escarpment approximately 500 feet high that nearly spans the width of the country. Throughout Saudi Arabia areas of enormous volcanic deposits exist, in addition to a few large white salt flats. These geological formations serve as excellent checkpoints for VFR.

Flying over that particular terrain everything looked the same, at least that was an initial impression. My first flights in Saudi Arabia were as copilot, thus familiarizing me with the terrain, routes and flight operation. I flew dual to each major site at least three times before being allowed to fly personnel and cargo on my own. During these flights I tried to spot conspicuous hills and rock formations for checkpoints. Using these features and others shown on my dual flights, plus a few radio aids, navigation became easier.

We had two main types of navigation in Saudi Arabia—pilotage and dead reckoning (DR). There were some radio aids but not nearly as many as a comparable size area in the United States. Considering the size of the country and the few available radio navigation aids, it was necessary to have good checkpoints, good visibility and to hold your heading. Our field site locations were equipped primarily with ADF radio beacons. Only two had VOR facilities and published approaches. Shortly after we arrived a VOR and an ADF approach were published for Riyadh International, but that still left four field sites without published approaches. Khamis Mushayt in the southwest has an unpublished VOR-TAC, surveillance radar and an occasional DF steer, but the Saudi Arabian Air Force had priority on that so it was seldom

Flight line at Tabuk

Photo by Captain George Magrath Jr.

Flying over the escarpment

Photo by Captain George Magrath Jr.

open to us. It was 466 nautical miles and took 3 hours utilizing pilotage and DR.

The size of the country and scarcity of navigation aids frequently meant losing contact with the ADF beacon about 1 hour after departure, flying for an hour or so using terrain features as checkpoints, then picking up the ADF from the destination. When minimum VFR conditions were in effect, usually due to thick haze or blowing sand, VOR would bring us in close to the station. However we could begin receiving signals only 30 or 40 minutes from the station. Of course the radios that we did have were invaluable to us. Besides our VOR receivers each aircraft had a main VHF communications transmitter-receiver and a standby emergency VHF transmitter, two ADF receivers and an HF communications transmitter-receiver.

VFR weather conditions in Saudi Arabia existed better than 90 percent of the time. When IFR conditions did go into effect, that usually meant sandstorms. Watching a sandstorm approach is reminiscent of the fog rolling in off the bay at Monterey, Calif., except it's brown and accompanied by strong winds. They normally reduce visibility to zero-zero, and habitually extend over quite a bit of territory. Flying through one was nasty business, with every nerve on edge, not to mention the effect on the engines.

Saudi Arabia is bordered on the west by the Red Sea. Extreme temperatures common to this part of the world caused high relative humidity along the coastal areas. Humidity toward the interior was always quite low, even in the winter. Prevailing winds normally came from the southwest. Thus the warm moist Red Sea air would blow against the mountainous rocky west coast resulting in almost daily cumulus and thunderstorm buildups over the western escarpment. When coupled with a large, low pressure area these conditions produced extremely nasty weather.

Although temperatures were extremely hot in summer, they were often quite cold in winter. They varied from about 130 degrees Fahrenheit in summer to nearly freezing in winter. As was usually the case in Vietnam, all aircraft maintenance was performed without benefit of hangars. This was particularly difficult on the maintenance crew. In the extreme temperatures encountered on the ramp it was not uncommon for a mechanic to burn his hand on a tool which had laid in the sun for a few minutes. These temperatures reached such extremes that a section on one aircraft's windshield developed cracks from the intense heat. Another example of the unbearable heat occurred in Jizan several years ago. The

Continued on page 28

Photo by Captain George Magrath Jr.

Riab International Airport

Charlie and Danny's Write-In

Dear Danny: It seems that most aviators who fly the UH-1 or AH-1G are reluctant to fly an aircraft that has a cracked or damaged lift link. The dash 10 does not seem to cover it clearly; what is your opinion?

G. A. H.

Danny's answer: Upon coordination with the U. S. Army Aviation Systems Command, Engineering Section, it seems that the lift link when cracked or damaged in some way will have a tendency to make the aircraft vibrate more than normal. A cracked or damaged lift link is not a safety of flight hazard, but upon completion of the mission the aircraft is in a red X status and is grounded until it is replaced.

Dear Danny: I have a question on the OV-1C dash 10, TM 55-1510-204-10/4 with changes. Turn to page 4-6, paragraph 4-55.4 and note reference to system air supply switch. My question is, Why is this noted in the dash 10 for the "C" model of the OV-1 and not listed for the "D" model? It looks to me like this particular sentence would be applicable to both models and should be listed in both manuals.

SSG C. V. S.

Danny's answer: That is a good question Sarg and we agree the procedure applies to both models. However, it has been determined that it is not necessary and will be deleted from the "C" model dash 10 in the next change. Actually the first step in the procedure shuts down the engine as the prop is feathered and moving the switch to the closed position is not necessary.

Dear Danny: Have you noticed that instructions for operation of the marker beacon sensitivity switch as contained in the Airman's Information Manual, part I, page 1-11, paragraph 4.a., and the instructions shown in the OV-1 operator's manuals, chapter 5, do not entirely agree? Personally, I prefer the procedure as shown in the dash 10s; what are your feelings?

MAJ C. R. B.

Danny's answer: We feel that the instructions contained in both publications are correct and are not contradictory as they would appear. The reasoning behind the procedure in the dash 10 is as follows: Set the sensing switch on the "hi" position, adjust the volume to a desired level when the tone is received, then go to the "lo" position. When set at "hi" the receiver is more sensitive resulting in a broader signal spread, then when placed on "lo" the receiver is less sensitive resulting in a narrower spread and therefore a more accurate fix. Paragraph 4.a. of the AIM, part I, states the sensitivity switch should always be operated in the "lo" position for proper reception. We agree with this statement but go one better by going to the "hi" position first for positive identification, then to the "lo" position. Bear in mind the length of time this signal will be received depends on the position of the switch, altitude, speed and position of the aircraft over the fix.

Dear Danny: In TM 55-1520-210-20, change 7, chapter 3, section II, page 3-22, special inspection area 5, states that "after the helicopter has been operated in rain, open the engine inlet area and remove upper air filter assembly, inspect and clean sand and dust separator parts." Does the pilot need to make a write-up after flying in rain? Also, when should the inspection be pulled—immediately after landing or during the daily inspection?

CPT C. T. G.

Danny's answer: Contact was made with the U. S. Army Aviation Systems Command, Systems Engineering. Their findings were that a write-up should be made in the DA Form 2408-13 on completion of a flight made in rain and an inspection should be made prior to the next flight. A DA Form 2028 has been sent to USAAVSCOM requesting this information be added to TM 55-1520-220-10.

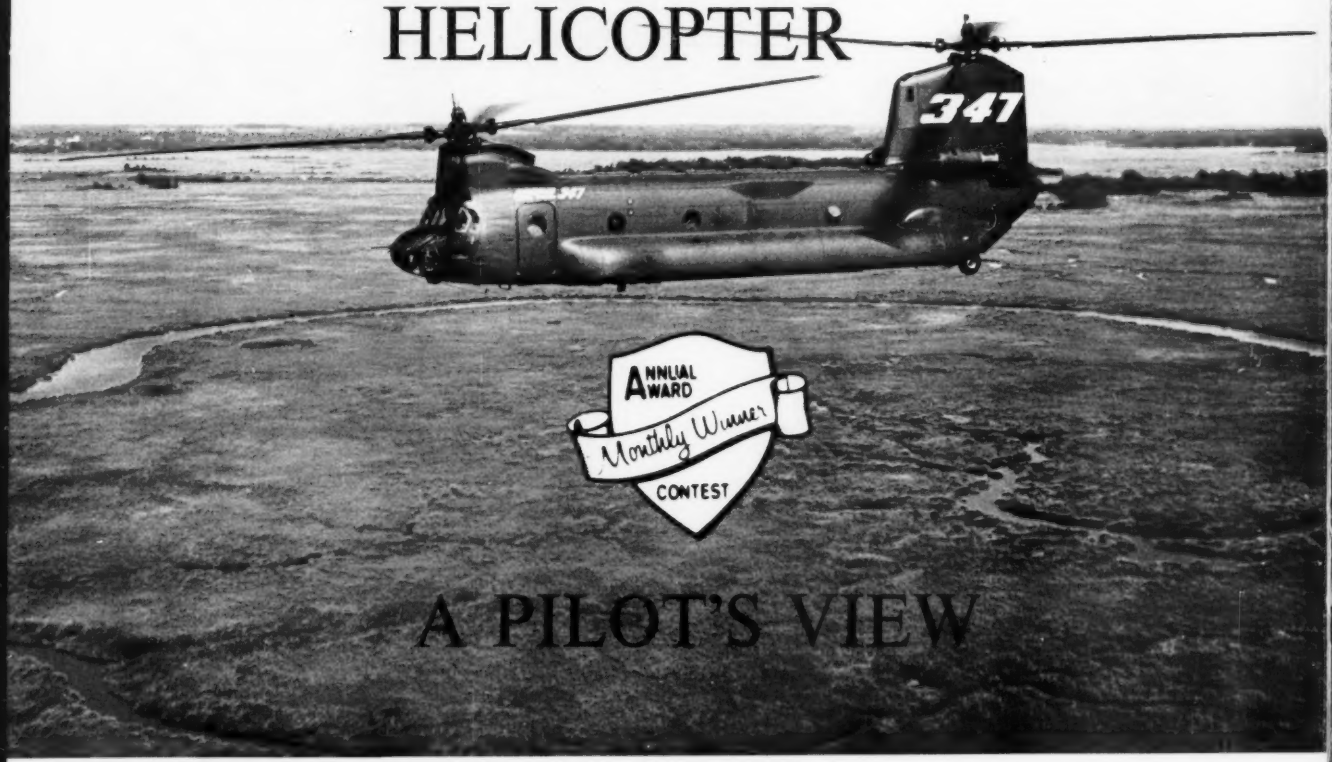
Dear Danny: In the UH-1D and H aircraft the inverters produce 115V A. C., a 28V A. C. transformer provided power for the course indicator,

torque pressure instruments, transmission oil pressure transmitter and indicator, engine oil pressure transmitter and indicator, and fuel pressure transmitter and indicator. Why is it when making the inverter check in the engine runup and when switching from spare inverter to the off position the engine, transmission and torque pressure gauges drop to a static reading but the fuel pressure continues to carry a positive reading?

CW2 J. B. M.

Danny's answer: According to TM 55-412, November 1968, subject: "Fundamentals of Aircraft Instruments," chapter 5, paragraph 2, page 22 gives a discussion of the principles of this fuel pressure gauge. It is a motor-driven instrument and will maintain a reading when the current is turned off. It will maintain that reading until the current is turned on. The other gauges are magnetic and will return to a static position when the current is turned off.

THE MODEL 347 HELICOPTER



A PILOT'S VIEW

Frank H. Duke

Since writing the article on the Boeing/Vertol Model 347 describing the advanced technology program and projecting the benefits in hauling qualities, vibrators, vibrations, noise and all-weather operation, the ship has flown 332 hours and the test results obtained by both the Boeing test activities and by the U. S. Army Aviation Systems Test Activity, Edwards Air Force Base, Calif., have been most gratifying.

In addition to the original test activities planned for the Model 347 demonstration, the aircraft has been used to obtain base line data for the HLH cargo suspension system. The phase I pure helicopter test activities were completed in mid-August when the aircraft was returned to the factory for installation of the wing. The phase II wing installation should be completed with rollout and ground tests slated for next month. The first flight is scheduled during December.

William P. Jones
Project Manager

A STRETCH MODEL of the tandem-rotor CH-47 Chinook helicopter it produces for the U. S. Army is being tested by the Boeing Company, Vertol Division. Designated as the model 347, it is undergoing an extensive two-phase research program which will provide information based on combat experience gained in the Republic of Vietnam for improvement that could be incorporated for the next generation of aircraft.

The two-phase program integrates simulation, wind tunnel, whirl tower and bench tests . . . as well as flight testing of the modified CH-47 airframe which will be the demonstration vehicle for first-hand evaluation by the Army. The objective of the first phase of the program is to establish new standards of flying qualities for conventional tandem transport helicopters. The sec-

Frank H. Duke holds a Bachelor of Science degree in mechanical engineering and is a graduate of the U. S. Navy Test Pilot School. Flight experience included duty as a jet fighter pilot and helicopter transport pilot with the U. S. Marine Corps. He has been employed in the helicopter industry for 12 years, 10 of which were pilot assignments. He is currently assigned to the Model 347 and is flying experimental and developmental flights as the project pilot

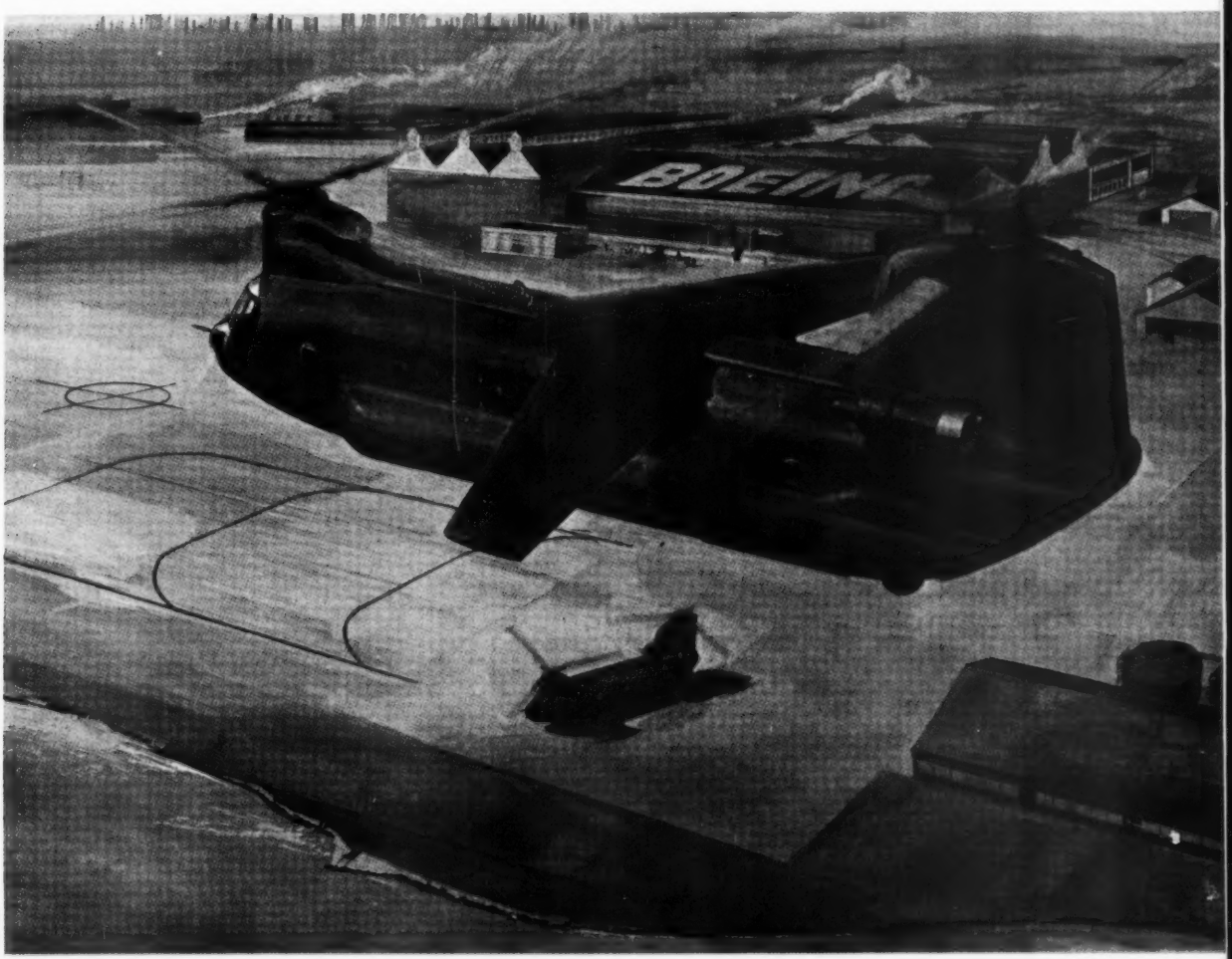


Table 1

	CH-47C	Model 347
Fuselage length	50' 9"	59' 11" (110" Extension)
Fuselage height (rear pylon)	17' 1"	19' 7" (30" Extension)
Rotor configuration	2 3-bladed rotors, 30' radius, no offset, flapping hinge	2 4-bladed rotors, 31.5' radius, acoustic tip design, flapping hinge offset 27.5'
Transmission capability	6000 SHP	7500 SHP (uprated)
Powerplant	2 T55-L-11 3750 SHP Maximum	2 T55-L-11 3925 SHP maximum (uprated)
Landing gear	Fixed Quadricycle	Retractable quadricycle

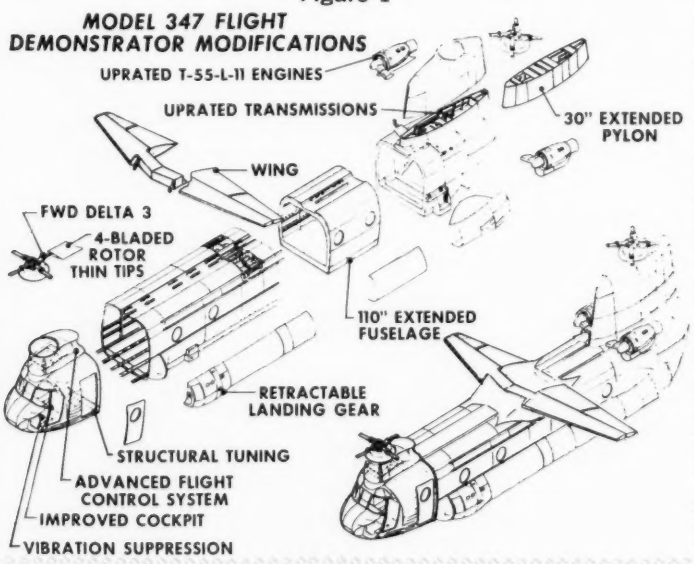
ond phase will be to evaluate the improvements in the maneuver capability of a transport helicopter through the use of a wing.

Pure Helicopter Phase

Although not all of the phase I program objectives are within the scope and purpose of this article, those which are apparent to the pilot include:

- Complete IFR capability including external load missions and unfamiliar terrain.
- Low vibration levels throughout the flight envelope.
- Elimination of blade "bang" and a reduction of the transmission noise. Cockpit to meet MIL-A-8806A noise requirements.
- Improve helicopter flying qualities beyond the current state-of-the-art by the use of inherent "designed in" stability, an advanced flight controls concept and flight path control system integration.
- Evaluate and integrate available avionics and navigation equipment to improve mission capabilities and gain an understanding of the advantages of an integrated flight control, navigation and approach capability.

Figure 1



- An alternate gross weight capability of 54,000 pounds.
- A maximum level flight speed in excess of 175 knots true air speed (TAS).

To accomplish these objectives a CH-47 airframe was modified as shown in table 1 and figure 1. These changes will be evident to the pilot in several ways. The fuselage "stretch" in length and height provides an improved level of inherent stability. Directional stability is enhanced by the increase in tail pylon surface area and pitch stability is improved by the increased rotor separation. Together these changes reduce the level of pilot effort required to fly the helicopter with stability augmentation off, and permit reduced authority stability system actuators which increase the delay times required for pilot control in the event of a stability system failure.

The rotor blade flapping hinge, also referred to as a "delta 3" hinge, increases the pitch stability of the aircraft by mechanically coupling rotor blade pitching motions as the blade flaps vertically. This flap-pitch coupling reduces the blade angle of attack as it flaps up. Bacause the coupled pitch motion is in the stabilizing direction, the aircraft is inherently more stable in pitch and less sensitive to gust disturbance.

In addition to these physical changes, the flight control system was extensively modified to improve the handling capabilities and to permit the integration of avionics and navigation equipment into the control system and thereby achieve an automatic flight path control system (FPCS).

The FPCS/flight director modes available to the pilot include those which currently exist in military fixed wing aircraft,

i.e., VOR, Doppler, heading and ILS. Added to those are modes for homing (FM), remote area approach and a self-contained, preprogramed approach to a preselected point over the ground. The flight director command information associated with each of these modes can be satisfied by the pilot manually or automatically by coupling the autopilot to the flight director. Table 2 defines the aircraft configuration relative to the FPCS, flight director and navigation equipment. Figure 2 illustrates schematically how these improvements are integrated into the control system.

To ensure maximum pilot efficiency the cockpit was modified to include the following appointments designed specifically for crew comfort:

- Cockpit environmental control.
- Vented seat cushions with integral air circulators.
- Improved (airline type) pilot seats with comfort and adjustment features not available in helicopter seats.
- Cockpit acoustic treatment.
- Improvements in switch accessibility and location.

The control force feel system was modified so that the longitudinal and lateral force breakouts and gradients vary with the speed of the helicopter. This requirement is considered necessary because the forces which are optimum for conducting a hovering task with external visual clues close to the ground are not optimum for maneuvering the aircraft at altitude, particularly at high speed. Specifically, the pilot finds high breakouts and gradients in hover annoying and frequently disengages the force feel system in this flight regime.

Finally, to ensure that the pilot is provided with all of the information necessary for conducting a mission with maximum safety, the aircraft was modified to include a cockpit cruise glide indicator (CGI) and a power available indicator (PAI). The CGI is a system which monitors the stress load in the nonrating control system and displays this load to the pilot as a needle deflection. If the aircraft is flown

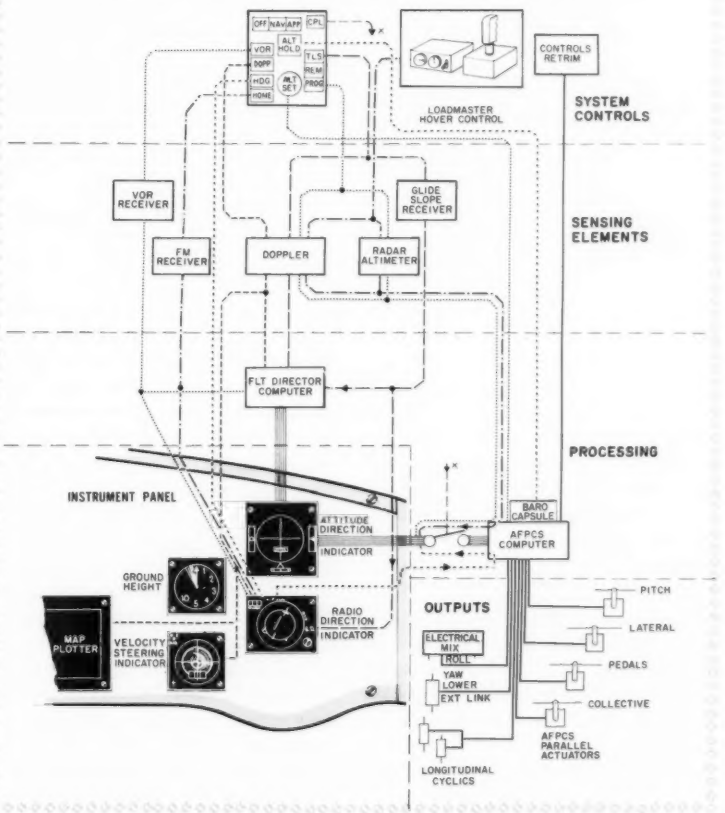
Continued on page 29

Table 2

Self-contained navigation system Enroute navigation equipment and associated displays	• Canadian Marconi ASN-64/APN-175 • Collins ILS/VOR localizer 51R-8 • Bendix map plotter • Sperry HZ6B flight director system • Canadian Marconi velocity—steering indicator
Terminal approach systems	• Bendix ALA-51 radar altimeter • Collins ILS/VOR localizer 51R-8 • Collins glide slope receiver 51V-5 • Self-contained approach from forward flight to hover

Figure 2

MODEL 347 AUTOMATIC FLIGHT PATH CONTROL SYSTEM



ADVERSE EFFECTS OF DOWNWASH

Colonel William P. Schane, M.D.

Provided by the Society of U. S. Army Flight Surgeons

IT WOULD BE NICE if everyone could work in a quiet, warm, unperturbed and unpolluted environment but many times this is not possible. Most soldiers must, at some time or other, get out in the wet, cold, uninviting elements.

The men who attach slingloads and others who must work in the downwash of a helicopter get a double dose of adverse elements. They not only contend with the weather but also endure the high winds commonly experienced in helicopter downwash force fields filled with dirt, sand and trash.

About 4 years ago the U. S. Army Aeromedical Research Unit (USAARU) at Ft. Rucker, Ala., conducted a preliminary investigation into the medical effects of high winds and rotor blade downwash. It was learned that German investigators in the early years of World War II had found that in winds of over 100 knots some sort of face protection was necessary. Researchers in the United States and other countries determined that when the face is protected there is no apparent damage to human beings in winds of less than 375 knots. Above this, some people develop small hemorrhages on the chest and shoulders. At about 400 knots it becomes increasingly hard to breathe; at 460 knots severe hip and chest pains sometimes appear; and at 515 knots severe hemorrhages may develop.

Helicopters used by the Army today do not produce downwash that is of sufficient strength to harm human beings in this way. However, experimental aircraft which can generate winds of this magnitude have been tested by the Army.

Dust, sand and other foreign matter have long been a recognized problem with helicopters, causing superficial airframe damage such as pitting and abrasion. Considerable energy can be imparted to sand particles by downwash. In general, however,

all parts of the body except the eyes will not be harmed if ordinary battle dress is worn. Eyes on the other hand are extremely susceptible to sand damage. Since all Army helicopters generate winds above that required to make sand airborne, eye protection is absolutely necessary.

In areas where injurious dust becomes airborne, the respiratory tract needs to be protected. Since every aircraft in the Army inventory can cause dust to become airborne, it is essential that adequate countermeasures be taken to protect the respiratory system as well. Work done during World War II indicates that goggles and oxygen masks are blown from the face with winds of about 174 knots, and that the flight helmet is torn off by winds of about 217 knots. It seems reasonable to assume that the face protective mask could be blown off by winds of this same magnitude.

Tests made by the National Aeronautics and Space Administration (NASA) show that walking against a wind of the velocity commonly encountered under a helicopter can be extremely energy consuming and could produce considerable fatigue. A soldier walking at 2.7 miles per hour on level ground carrying a 58-pound load consumes 2,900 calories of energy per minute (2.9 kilocalories per minute). He expends 64.44 kilocalories walking 1 mile. The same man walking 1 mile under like conditions but against a 50-knot wind would expend 475 kilocalories, more than seven times the energy.

It is possible for men working in helicopter downwash to suffer body cooling and hypothermia. Wind chill is severe at winds of 40 mph and could cause hypothermia with prolonged exposure. However, TB MED 81, Cold Injury, 20 October 1964, points out that wind speeds greater than 40 mph have little more effect than winds of 40 mph, so all the Army's helicopters pose an equal threat in body heat dissipation. On the other hand since a man working creates 10 to 20 kilocalories per minute in heat as a by-product of muscular effort, he would be protected to some extent. It appears that although massive convective heat loss is possible at very low temperatures, ordinary clothing precautions are sufficient to protect against it.

No specific study has been undertaken to evaluate the ability of a man to maintain his equilibrium in high winds. However, a project conducted in 1963 for a completely different purpose gives some information. Calculations from this research show that gusts of 75 knots and over disorient beyond recovery a standing or walking man.

From a practical standpoint downwash is always associated with high sound pressure levels in the range of 110 to 115 decibels (db). Military standards indicate that ear protection is necessary when sound pressure levels exceed 92 db in the 150 to 300 hertz (Hz) octave band and 85 db in the octave bands between 300 to 9,600 Hz. Ear protection, therefore, is essential in areas of downwash to prevent both temporary and permanent hearing loss.

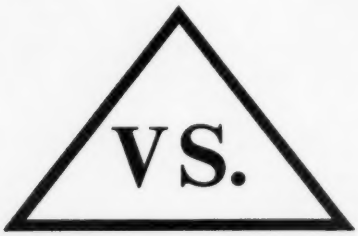
There has been some concern that the wearing of ear defenders would impair communications among persons working in the downwash field. In January 1968 USAARU conducted speech intelligibility tests under a modified UH-1B. Phonetically balanced word lists were used, the speaker and listener were 1 meter apart and the word list was spoken as clearly as possible at the level of a shout. Intelligibility was zero percent. It appears, therefore, that spoken communication in downwash fields is difficult at best and that the wearing of ear defenders will not appreciably degrade the already poor communications.

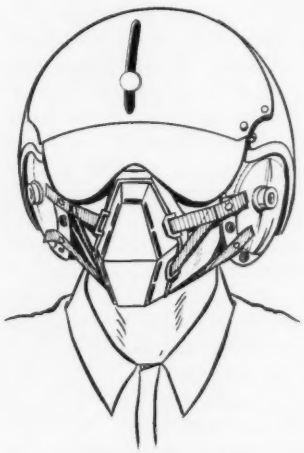
The result of USAARU's study indicates that the downwash from rotor blades of Army helicopters will not normally harm men provided the eyes, ears and, when necessary, respiratory system is protected. Working in the high winds can be tiring but the wind chill factor is no problem when the worker is properly dressed.

This scholarly article brings attention to a neglected area of aeromedical support: the protection of ground support personnel. Many Vietnam veterans are familiar with the "dust-bowl" effect experienced when landing on sandy stagefields and landing zones. Xuan Loc was an oft used refueling area with as many as 12 helicopters refueling simultaneously. Refueling technicians would labor in these areas for many hours unprotected from noise and sandblast. A lucky few wore goggles; most wore the "ole western bandana." If the frequency of injury was low it was fortunate. Certainly efficiency and productivity must have ebbed. No one can do a good job when he must worry about his eyes, hearing and breathing.

The same personnel require protection today (refueling technicians, slingloading crews, cargo handlers, etc.). Protection maximizes productivity and efficiency. Is it used?

It is available! A number of approved devices are available





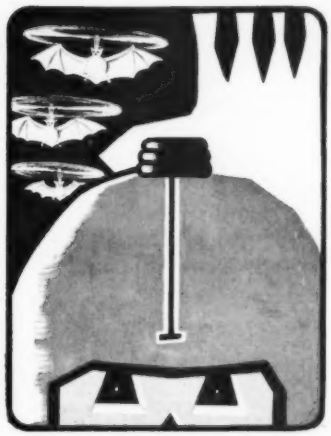
through supply channels. TB MED 251 provides specific information regarding the availability of ear muffs (protectors). Ear muffs are superior to ear plugs in this instance for they are more likely to stay in place. TB MED 223 provides for respiratory (breathing) protective devices (even throw away surgical masks have been used). Many air purifying respirators, approved by the U. S. Bureau of Mines, can be requisitioned. Finally, *safety* glass goggles can be ordered through regular supply channels (unless prescription lenses are required, then medical supply channels). Federal stock numbers for theses devices are listed in supply catalog C-65-15-IL.

Granted, this is throwing together a lot of paraphernalia but it's all available. Perhaps some thought should be directed toward the development of an integrated helmet-mounted protective device. Ground crews in combat are frequently required to operate hurriedly among crowded helicopters. In addition to ear, eye and breathing protection they could benefit from protection against at least glancing blows to the head. Tail rotors must be avoided and downwash from other choppers frequently makes the main rotor a hazard.

Granted, a direct blow is probably nonsurvivable. A baseball cap hard helmet with an integrated safety glass visor and ear cup protection might be the answer. A suspension similar to the SPH-4 would provide for well ventilated crown as well as head protection. The ear muffs could be attached by a sturdy fabric to allow comfort and ventilation as well. Finally, snaps could be provided for the attachment of an air purifying respiration mask. A chin strap would ensure that the entire apparatus would stay in place in face of the windest egg breaker. Thus, ground crewmen would have personalized head, eye, ear and respiratory protection permitting safe and comfortable accomplishment of their jobs.

A few might wail about the discomfort of it all, but it is difficult to understand how irritated (perhaps even injured) eyes, noise-assaulted ear drums, draining nose or choked up breathing can be a preferred alternative. One way or the other, the problem exists and a number of solutions, immediate and future, are in the offing.

VIEWS FROM READERS



Write us today!
Your views are valuable. . .
Share them with Army Aviation

Sir:

Being an Army helicopter pilot, I read with interest the inclosed article ["On Fire And Going Down"] published in the May 1971 AVIATION DIGEST.

Captain Bristow mentioned several times the necessity of a survival radio. However, his unit had an insufficient quantity. My unit Dustoff is faced with similar problems of survival equipment shortages. This includes radios, survival vests, SPH-4 flight helmets and the bullet-proof vest worn by aviation personnel. In regards to the vest several of our aviators are forced to wear the plates secured under the inertia harness. This is done when the canvas cover with straps is not available. The possibility of it becoming a lethal weapon in a crash situation is evident when worn in this fashion. All the above items have been requisitioned with no results.

It is an appalling fact to note the date of Captain Bristow's experience and realize, over 2 years later, the same problems of procurement and distribution coupled with similar survival situations are occurring still; the most recent in my unit being only last month.

Being aware of the expense and time the Army has incurred in my own, as well as my crew's training, it seems only logical to invest a few dollars more to ensure safety of flight crews as is done in our sister services. However, if such equipment has been procured it would appear evident the distribution of such items be revised.

CW2 William R. Yancey
HHC, 326th Med Bn
101st ABN Div (Airmobile)
APO San Francisco 96383

Sir:

Two separate items drew my attention in Captain Bristow's article "On Fire and Going Down" in the May 1971 issue. I have to comment on these two quotes: "We did not have a survival radio because of the critical shortage of them in the unit," and "I wore no gloves because none were available, and was very lucky just to be singed on the backs of my hands." For God's sake are Army aviators ever going to be given a fighting chance for survival? The title of a hit states, "You've Come a Long Way Baby," and we have too in many operational areas, but we've got a long way to go if conditions like these are allowed and continue to exist.

LTC Lawrence J. Stone
Aviation Officer
HQ I Corps
APO San Francisco 96358

Sir:

A recent edition of the AVIATION DIGEST published the Federal stock number for NOMEX thread. Request the FSN and availability of the thread be provided.

The March, 1970 issue of AVIATION DIGEST states that an index for the 1969 DIGEST is available. Request one copy of the index and also indexes for the 1968 and 1970 DIGESTS. These are needed to complete our library of AVIATION DIGESTs.

MAJ William A. Jugel Jr.
Avn Safety and
Standardization Board
APO 09205

•The Federal stock number for Nomex thread is 8310-492-8397. In the supply catalog it is listed as "thread, nylon, nonmelting, shade OD." We have been advised that the thread has a PF SMR code which indicates that it is available at direct support level, however normally not available at unit/organizational level. Our supply of AVIATION DIGEST indexes have been depleted.

Continued on page 34

The Armed Helicopter Story

Part IV:

The Army has tested many armament systems in the development of its airmobile concepts. This part of "The Armed Helicopter Story" catalogs those systems devised before formal testing began. Systems given official designations will be carried in subsequent issues

Lieutenant Colonel Charles O. Griminger

"VANDERPOOL'S FOOLS" had worked long hours throughout June 1956 at the U. S. Army Aviation School (USAAVNS), Ft. Rucker, Ala., to develop a helicopter armament kit*. Then in July 1956 the big day arrived when their first armament kit was ready for live fire tests. It consisted of two .50 caliber machine guns and four Oerlikon 8 cm fixed fin rockets mounted on an OH-13 helicopter. The tests were conducted with extreme caution since no one knew exactly what would happen when rockets and machine guns were fired from a helicopter.

Captain James Montgomery fired the first machine guns with the OH-13 helicopter tied down on an elevated wooden platform. Next, the guns were fired with the aircraft at a hover and then in forward flight. Since no damage to the aircraft resulted from firing the machine guns, the rockets were tested using the same procedure and no ill effects were noted.

A .50 caliber machine gun was chosen purposely for the first test because it was feared that such a weapon would overstress the helicopter. The aim of the original test was to deliberately place excess stress on the airframes to see what they could take. Later firings of the .50 caliber machine guns caused the plastic bubble of the helicopter to burst into fragments. It was determined that the bubble was in direct contact with rivets and that the virbration from the machine guns caused it to break. This problem was solved by soft-mounting the bubble.

As experiments continued at

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* See "We Armed The Helicopter," June 1971 DIGEST and "The Armed Helicopter Story, Part II: Vanderpool's Fools," August 1971 DIGEST

Ft. Rucker, Colonel Jay D. Vanderpool (who had been assigned the project of developing and testing helicopter weapons systems) and Lieutenant Colonel F. C. Goodwin visited the General Electric Company in Burlingto, Vt. They consulted with GE engineer Thurwood T. Mayhood. Armed with only a drawing on a paper napkin and no money, COL Vanderpool asked GE to build a rocket kit for a helicopter. After conferring with his associate, Jack Harding, Mayhood agreed to build the kit and promised it in 3 months.

The GE kit, when delivered, consisted of a package containing two 7.62 mm M-60 machine guns and an eight tube 89 mm rocket launcher. The package was designed to be mounted under the skids of an OH-13 helicopter. It was to fire the 89 mm antitank aerial rocket, an experimental rocket made by Redstone Arsenal, Huntsville, Ala. But by the time the GE kit arrived the supply of 89 mm rockets had been exhausted. The kit was then modified to fire the 2.75-inch folding fin aerial rocket (FFAR). Due to final rocket clearance of the machine gun barrels, only the four center 2.75-inch rocket tubes could be used.

This was the first helicopter weapon which could have its elevation changed inflight. Due to the kit's weight, ballast had to be carried on the left skid of the helicopter. The kit presented other problems in that the left gun was hard to load and the lack of ground clearance damaged the rocket tubes.

The Emerson Electric Manufacturing Company in St. Louis, Mo., became active in the armed helicopter program in the spring of 1958 when it conducted a company-sponsored program at Ft. Rucker. Later that year Emerson received a contract to develop a "quad gun kit." Fabrication of the kit began in the fall of 1960 using the M-73 machine gun. The quad gun kit was developed by the Army as a means of providing the helicopter with fire suppression capability through the use of a flexible, power-operated machine mounting. Although it was designed for operation on the CH-21, CH-34 and UH-1, its operational use has been applied only to the UH-1. The system was designated the XM-153 and later the XM-6 when the M-73 guns were replaced by M-60 machine guns.

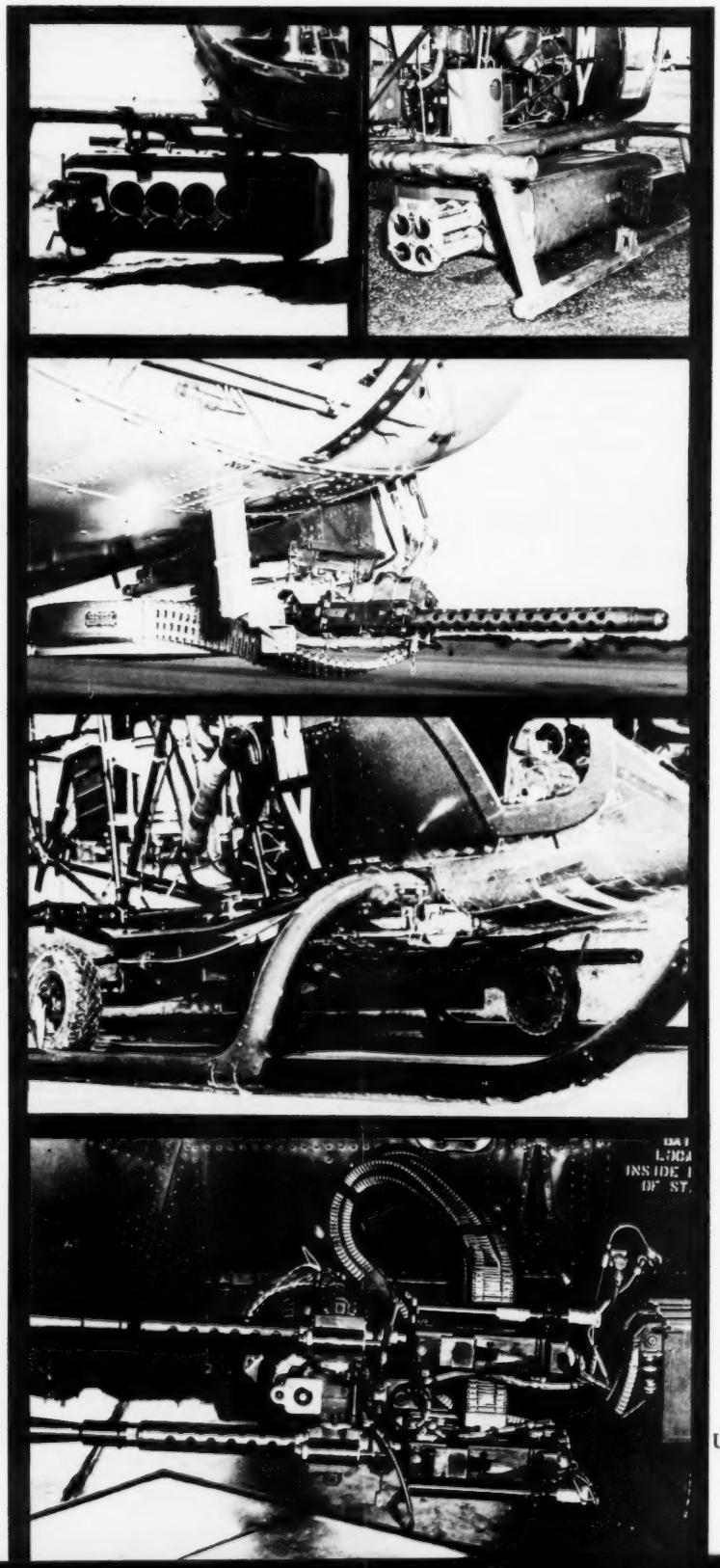
Townsend ground-fire suppression kits were manufactured and installed on an OH-13 and CH-21C by the Townsend Company in Santa Ana, Calif. Development was initiated in January 1958 and was to be conducted using the M-37 machine gun. Lieutenant Colonel William H. Byrd Jr. and Mr. Joseph E. Givens were members of the crew who flew the helicopters from California to the U. S. Army Aviation Test Board at Ft. Rucker on 23 October 1959. LTC Byrd was Test Director at that time and Mr. Givens worked with the Test Board as a Department of the Army civilian. The kits were evaluated by the Test Board and the 8305th ACR Company but proved to be too heavy.

Meanwhile, Aerial Combat Reconnaissance Company experiments at Ft. Rucker led to development of the .30 caliber M-37 armament kit, KX-13-A1-2. It was designed to provide the OH-13 with a ground-fire suppression capability and consisted of a lightweight aluminum frame designed for supporting the .30 caliber M-37, the .30 caliber AN-M2 aerial or the 7.62 mm M-60 machine gun. The gun could be remotely fired, elevated, depressed, charged and made safe by the pilot in flight without releasing the collective pitch or cyclic controls. The elevation traverse was activated by an electric motor and a linear actuator; the charging and safetying devices were operated by a pneumatic charger; and the gun was fired by a solenoid. This was the weapons kit from which Springfield Armory developed the M-1 and M-2 systems.

The amateur weapons designers of the ACR Company developed and modified many original kits before perfecting the KX-13-A1-2. CWO Lawrence C. Hammond, assisted by CWO Clarence J. Carter, was the principle designer of the system which became affectionately known around Ft. Rucker as the Hammond kit.

CWO Hammond began development of the KX-13-A1-2 by modifying one of the "Sky Cav" unit's early experimental kits forming the KX-13 kit which consisted of an M-2 aerial .30 caliber machine gun on a fixed, uncushioned mount. This produced excessive vibration and jarred equipment loose on the aircraft. The vibration problem was solved by modifying the KX-13 kit with a cushioned mount to form the KX-13-A1 which soon incorporated an improved ammunition feeding device.

The next step was the KX-13-A1-1 which was provided with a semiautomatic gun charging device developed by the ACR Company. Still not satisfied, CWO Hammond and his machinist continued to improve the system by developing an inflight elevating system. In order to reduce the weight, the kits were reconstructed in aluminum. This final development was the KX-13-A1-2, the forerunner of the XM-1 and the beginning of a formal program of development and designation of Army helicopter armament systems.



General Electric ground-fire suppression kit: Two each 7.62 mm M-60 machine guns, and one 89 mm rocket launcher; weight fully loaded, 270 pounds; maximum effective range (MER), 1,000 m; primarily used with OH-13. This kit was modified to use four 2.75-inch folding fin aerial rockets (FFAR) instead of eight 89 mm antitank rockets. Manufacturer (M.) General Electric Co. Procured in 1957.

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Townsend ground-fire suppression kit: One .30 caliber M-37C mg; 650 shots per minute (spm); MER, 1,000 m; further consideration after initial tests in 1959. M., Townsend Co.

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Seventh Army fire suppression kit: Two each .30 caliber M-37C mgs; 650 to 725 spm; weight, 261.5 pounds; tested in 1959 on the OH-13E, G and H models. M., Mainz Ordnance Depot. Tested in 1959; limited production.

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Emerson helicopter fire suppression kit, quad machine gun: Four each M-73 7.62 mm mgs; redesignated XM-153 series, primarily used with CH-21, CH-34 and UH-1A. Later modified by replacing the M-73 with the M-60 mg and designated the XM-6. M., Emerson Electric Co. Emerson received a contract to develop a "quad gun kit" in 1958.

The Aerial Combat Reconnaissance Company's personnel were amateurs, but their efforts led to the perfection of the U. S. Army's first helicopter kits

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4.5-inch rocket systems: In the late 1950s the Aerial Combat Reconnaissance Company at Ft. Rucker, Ala., experimented with 4.5-inch systems ranging from single tubes to 12 tubes, and a system for the UH-1 which could be turned inboard for firing (lower right).

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ACR's first kit (right): Consisted of two .50 caliber mgs and four Oerlikon 8 cm fixed fin rockets mounted on an OH-13. It was tested in July 1956.

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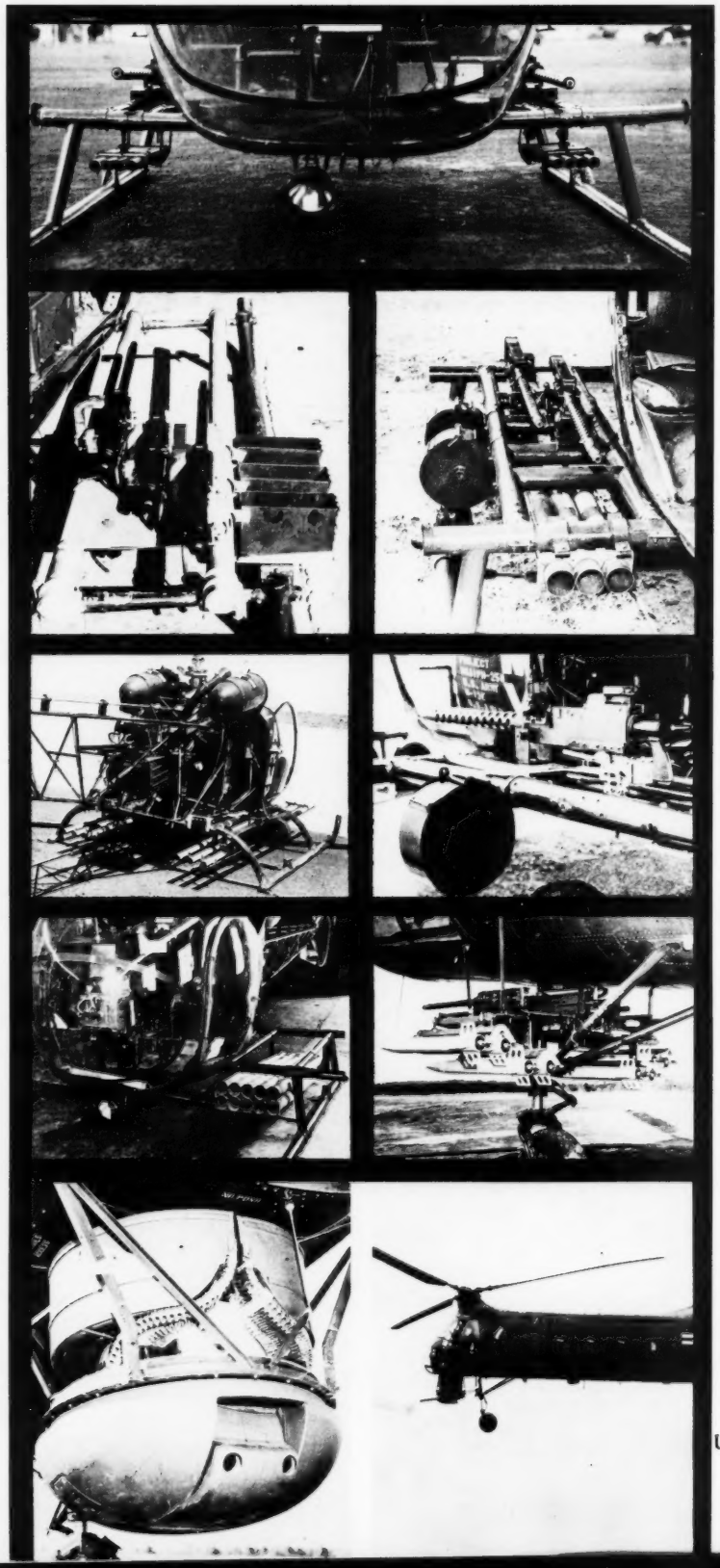
ACR's second kit (far right): Captain J. D. Roberts ACR's executive officer points to the kit which consisted of four .30 caliber mgs and four Oerlikon rockets.



The NAKA kit: Two .50 caliber aerial mgs and eight 1.5-inch NAKA folding fin rockets on the OH-13E.

Far left: Six .30 caliber AN-M2 aerial mgs on the OH-23C. Used to achieve as "overkill" to study Vulcan type gun effects. Later versions had two mgs and then one on each side. ACR also tested this with Oerlikon and 2.75-inch rockets. The OH-23 was dropped as a test vehicle in favor of the OH-13 which existed in greater numbers at Ft. Rucker.

Left: Four .30 caliber AN-M2 aerial mgs and six 2.75-inch FFAR. ACR also tested this kit with 12 rockets. The system was effective, but exceeded the OH-13E load capacity.

Far left: Two . 30 caliber AN-M2 aerial mgs and six T-214 2-inch FFAR on an OH-13H with 6-foot tubes (later increased to 10 feet).

Left: The .30 caliber M-37 tank mg with a 250-round ammunition drum. The AN-M2 mg was in limited supply and the M-37 could be obtained by ACR through ordnance channels.

Far left: Two pods of ten 89 mm aerial antitank rockets on an OH-13E. The system, evaluated by ACR in September 1957 at Ft. Rucker, used the "Weevil" T-290 fixed fin aerial rocket developed by Redstone Arsenal.

Left: Two .30 caliber and two .50 caliber AN-M2 mgs and eight 8 cm Oerlikon rockets on nose of CH-21C.

B-29 gun turret: One B-29 gun turret with two .50 caliber aerial mgs on nose of CH-21C. Developed for ACR by GE, but exceeded weight limitations.

The Pockmeyer kit (right): Two .30 caliber aerial mgs and two 2.75-inch FFAR pods of 7 rockets each on CH-21C. The pod was built by Pockmeyer Inc., Los Angeles, Calif.

Far right: Two pods with six 2-inch T-214 FFAR each on a CH-21C. ACR tests included both 6- and 10-foot tubes, the latter being 40 percent more accurate.

Arrington kit: Two T-214 2-inch FFAR pods with 15 rockets per pod is mounted on the CH-34. Mr. W. F. Arrington (top center) manufactured the tubes at the Ft. Rucker machine shop for ACR. The 2-inch rocket was not used extensively because of its corrosive effects and it left a bad smoke trail.

Right: Two .30 caliber and two .50 caliber aerial mgs, plus two 20 mm AN-M2 mgs and two T-214 2-inch rocket pods of 6 rockets each on a CH-34.

Far right: Four .50 caliber aerial mgs and two 2.75-inch FFAR pods with 16 rockets each on a CH-34.

Old Ironsides kit (right): Two .30 caliber mgs on an OH-13. Developed and used by members of the 1st Armored Division (ROAD) in 1962-63 at Ft. Hood, Tex.

Womack kit (far right): Two .30 caliber mgs and two 2.75-inch FFAR mounts, each with a capacity of 24 rockets on the UH-1B. This kit was named for its developer, CWO Clemuel H. Womack.

Personnel of the 1st Armored Division in 1962 and 63 also developed .30 and .50 caliber machine gun kits for the UH-1. Information concerning, and photographs of these kits can be found in "A Year On The ROAD," June 1963 DIGEST and in "The Armed Helicopter Story, Part III," September 1971

UTT kits: A UH-1B of the Utility Tactical Transport Helicopter Company (far left) with the M-60C, 7.62 mm mgs and 2.75-inch rocket pod. At left, the UH-1 is armed with the M-37, .30 caliber tank gun and 2.75-inch rockets. For additional information on UTT armament see "The Armed Helicopter Story, Part III," September 1971.

Far left: An M-39 20 mm gun on a CH-34. It was developed by Springfield Armory and evaluated by the U. S. Army Aviation Test Board in 1961.

Left: An M-24 automatic gun on the UH-1B. Tested by the Aviation Test Board in 1963, and then by the 1st Cavalry Division (Airmobile) in RVN. Refined by Rock Island Arsenal, Ill., and designated XM-31 (see subsequent issues).

Hughes MK IV pod (far left): The MK II twin 20 mm gun on the CH-34. One of the first systems evaluated by the Test Board. CWO Stewart Park (at right) worked with the Hughes representative at left.

Vulcan kit (left): Three barrel modified M-61 Vulcan 20 mm automatic gun on the UH-1. It was tested by Bell.

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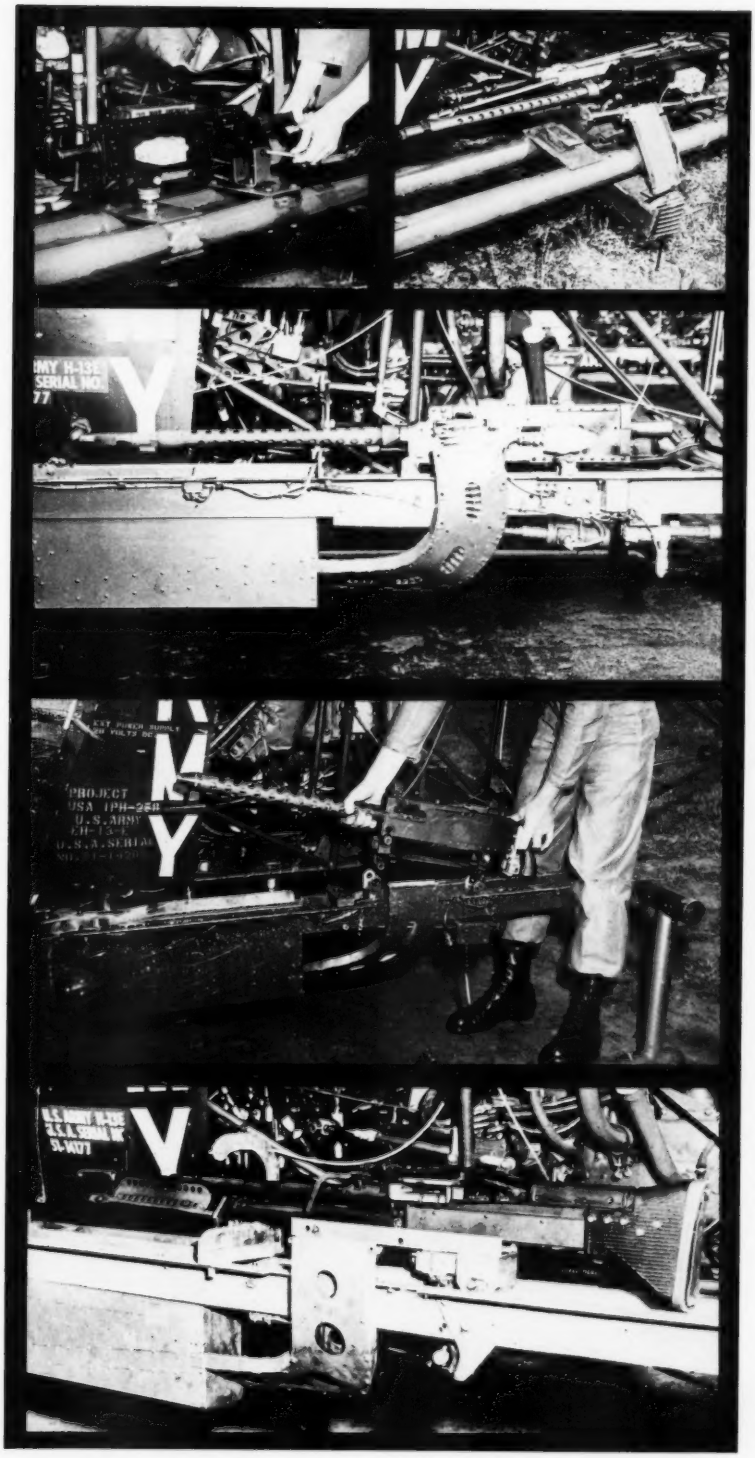
Left: Kaman Aircraft Corporation's UH-2 with a 7.62 mm quad mg in the nose and Aero 70 2.75-inch rocket launching tubes. It was evaluated by the Test Board in 1965.



KX-13 ACR kit (far left): Two each .30 caliber AN-M2 mgs; capacity, 250 rounds per gun; fixed uncushioned mount on OH-13E.

KX-13-A1-1 ACR kit (left): Same as KX-13 except cushion mounted and pneumatically charged (the KX-13-A1 was not pneumatically charged).

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KX-13-A1-2 ACR kit (left and below): The two kits above were the immediate forerunners of ACR's lighter aluminum armament kit which was able to mount any one of three mgs used in the field in the early 1960s. The top two-column photo is of the AN-M2 aerial .30 caliber mg. Below it is the .30 caliber M-37 tank gun, and at the bottom is the M-60 NATO mg. Additional information on these kits can be found in the May 1960 DIGEST. The KX-13-A1-2 led to the development of XM-1 and M-2 helicopter armament kits.

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Next month the DIGEST will continue with Part V of "The Armed Helicopter Story" which will cover armament kits that received formal designations.

Maintenance

EVEN WITH FIRE EXTINGUISHERS

Hydraulic Fluid: It should be common practice in all Army aviation units to dispose of all opened containers of hydraulic fluid MIL-H-5606 after use to prevent the possible contaminated remainder from being used. We therefore suggest that a hydraulic fluid dispenser, FSN 4920-245-1832, be used for storage of the unused portion of hydraulic fluid. This will prevent the unused portion from being contaminated making it unnecessary to waste the questionable remainder. The primary use of the dispenser is to service hydraulic reservoirs and bleeding brake systems but it can be used to store hydraulic fluid.

Fire Extinguishers: Monobromotrifluoromethane (CF_3Br) is highly volatile, but it is not easily detected by its odor. Although nontoxic, it must be considered to be about the same as other freons and carbon dioxide, causing danger to personnel primarily by reduction of oxygen available for proper breathing. Therefore, operation of the hand fire extinguisher should be restricted to actual emergencies. The liquid should not be allowed to come into contact with the skin as it may cause frostbite or low temperature burns.

Portable, hand-operated fire extinguisher, Monobromotrifluoromethane (CF_3Br), shall be maintained as follows:

- Weigh extinguisher cylinder every 6 months and replace if gross weight has decreased by 4 ounces or more.
- Replace with new cylinder immediately after use.
- Check safety pin lock for security and make sure that the lock wire seal is not broken.

For recharging extinguishers refer to instructions furnished with extinguisher. (TM 55-1500-1204-25/1, April 1970)

Matters...

SB9RU-3 Magneto On The R-985 Engine: Hey, U-6 Beaver maintenance men! When installing the SB9RU-3 magneto on the R-985 engine, have you had a problem with the rubber magneto coupling disc being either too large or too small? The reason could be the wrong size coupling disc was used. The disc comes in three sizes: a standard size (P/N 11052, FSN 2810-118-3269), a -.031 undersize (P/N 11052M31, FSN 2810-775-0563) and a +.031 oversize (P/N 11052P31, FSN 2810-118-3277). The standard size is identified by the letter "B" molded on the face of the coupling disc. The letter and number "B-1/32" identifies the undersize coupling disc with "B+1/32" as the identifier of the oversize disc.

Some mechanics have received a disc with no lettering molded on the face. The disc should be measured to ensure correct tolerance.

The recommended procedure for selecting the correct coupling is to mount the magneto on the engine without installing the rubber couplings (see TM 55-2810-224-24, pages 5-8, chapter 5, section C II, paragraph 5-21, k).

Measure the distance between the magneto drive shaft and the engine magneto shaft coupling, ensuring that the shafts are at their maximum distance apart. The rubber coupling to use should be 0.020 inch to 0.030 inch less in thickness than the distance between the two metal couplings. (Reference TM 55-2810-224-34P, figure 13, item 91A)

Survival Equipment: It was the policy of our company when on a mission in the Republic of Vietnam to have our own personal survival kits attached to our body. It was found that items not secured to the individual were lost or destroyed upon impact and on other occasions just forgotten altogether.

Sweeny Wrench: Some of the safety precautions to be used when using the Sweeny wrench ("Jesus Nut" wrench, P/N SWE 12037) are to make sure you have a clean area to work on, dry nonoily shoes and a firm grip on the wrench. It might be very funny to watch some mechanic slip and slide off the top of an aircraft, but not to the one who fell or not to the CO who has to sign the accident report and explain to battalion how it happened and what he is doing about it to preclude any reoccurrence.

Retorque Of Retaining Bolts: Twenty-five flying hours after replacement of main rotor blades on UH-1 aircraft, blade retaining bolt nuts must be torqued. (TM 55-1520-210-20, chapter 8, section II, paragraph 8-33)

Installing Inlet Strainer: When installing the fuel control inlet strainer on T-53, L-11 or L-13 engines, the strainer must be installed with closed end inward to function properly. (TM 55-1520-210-20, chapter 5, section IX, paragraph 5-369)

Cleaning Compound: Cleaning compound is flammable and its fumes are toxic. Do not use near flame and always provide adequate ventilation.

Tightening New Nuts And Bolts: It is good practice in torqueing, especially for new bolts and nuts, to first tighten the fastener to the desired torque value and then loosen the nut or bolt by backing off aproximately one-half turn. Then retighten to the specified torque value. This aids in cleaning and smoothing the threads and results in more accurate torque. (TM 55-1500-204-25/1, page 6-37, paragraph 6-152, d)

Tour Of A Different Color

Continued from page 7

temperature there was unofficially recorded at 148 degrees Fahrenheit! People who were present felt that the humidity exceeded 100 percent and could not understand why there was no rain. By the fall of 1970 adequate hangar facilities very similar to those used by stateside aviation units were in use.

Thermal conditions created by rising heat from the desert floor seemed inescapable during the summer. Aircraft that cruised higher than the service ceiling of a U-8D were even at times unable to avoid this turbulence.

Weather observation and forecast facilities in Saudi Arabia were extremely limited. Only three places in the country were capable of giving weather information prior to takeoff—Dhahran, Jidda and Riyadh. Forecast weather was available in Dhahran and Jidda, but not Riyadh. Current observations only were available in Riyadh, thus if you needed a forecast you had to check earlier observations and formulate your own. Weather facilities at all other field sites were nonexistent.

In Saudi Arabia several HF radio nets were in operation—one employed by the district, another by a private contractor who owned three aircraft. HF radios were present at each field site allowing us to make a weather check at our destination before we departed. However the man making the observation was never a qualified weather observer and frequently underestimated or overestimated conditions. Crude though it was it certainly was better than no weather information at all.

As mentioned earlier the three U-8D aircraft were equipped with HF radios. These were installed to communicate with the Saudi Arabian HF radio system (Jidda Control), as well as the district and contractors nets. Because they were relatively free of traffic, search and rescue operations could be initiated much quicker. Flight plans were always filed when possible, but in remote areas where no operations office existed they were filed by teletype or radio immediately after takeoff. We conducted flight following by contacting the contractor radio net immediately after takeoff, giving all particulars of the flight. After that an "operations normal" check was required every 30 minutes, to be given on the hour and the half hour. Naturally weather information could be monitored while enroute.

In monitoring the weather so closely our primary consideration, as in all matters relating to flying, was safety. When the forces of nature changed they did so rapidly. Airports too were few and far between, thus alternates had to be selected with care, bordering right on the edge of normal alternate requirements. Our single most important safety feature, and often our only means of communication, was the HF radio, a fairly recent innovation. Prior to that aircraft operated in Arabia with only VHF radios, dating from their initial entry into the country—quite sometime before I arrived.

Lack of good radio navigational aids caused night flying to be somewhat limited. Adequate forced landing areas were scarce enough in daylight, much less at night. The excellent maintenance available under these harsh conditions was our best safety precaution. Our maintenance personnel performed an outstanding job of holding problems to a minumum.

Regarding my own feelings about the tour, the experience gained and the lessons learned while flying in Saudi Arabia were of immeasurable benefit. The most rewarding feeling of all was having the responsibility to make decisions as an Army aviator.

Photo by Captain George Magrath Jr.

Goat herds are a common sight throughout Saudi Arabia

The Model 347 Helicopter

Continued from page 13

outside its approved envelope or is maneuvered too severely, the CGI will transmit this information to the pilot.

The PAI is an integral part of the engine torquemeter and provides the pilot with a means of adjusting a torquemeter red line so that it indicates the maximum power (torque) available from a "spec" engine for the existing temperature and pressure. This indication should be extremely valuable as a means of preventing the pilot from overcommitting the helicopter when the power available does not permit the use of maximum or red line transmission torque.

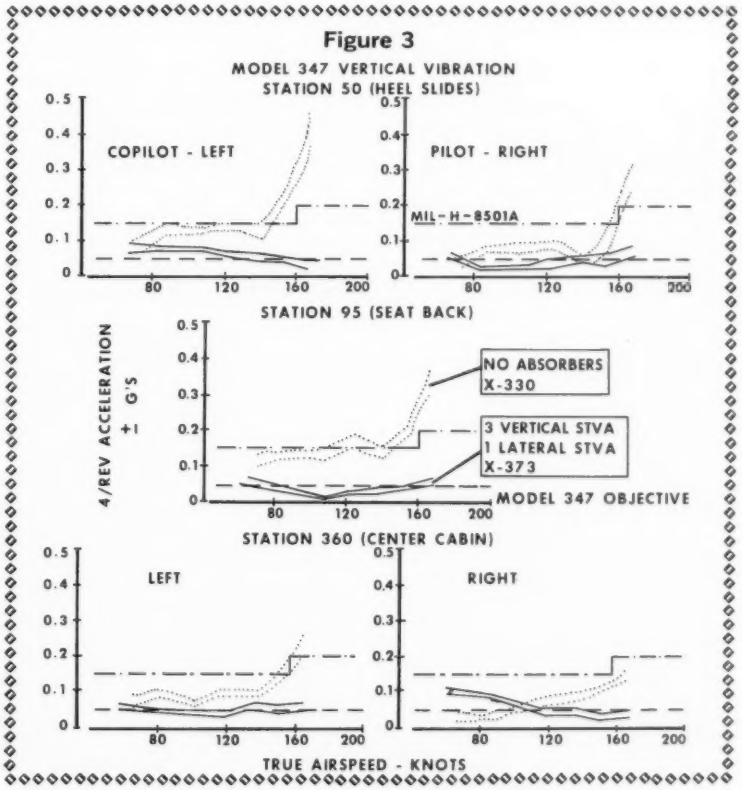
Flight Test, Phase I

The flight test program was initiated on 27 May 1970 when the helicopter was hovered to check out all essential systems. The following day the first forward flight was accomplished with none of the stability augmentation systems or vibration suppression devices active and with the landing gear locked down. Despite this "bare bones" configuration, there were no flying qualities, vibration or stress limitations encountered and the helicopter achieved a transmission torque limited level speed of 172 knots TAS. This was the first time to our knowledge that a helicopter has been able to explore the flight envelope to the power limited speed on its maiden flight. It was immediately apparent that the analyses and engineering effort accomplished previously had not been without reward. The pilots were enthusiastic in their praise of the absence of objectionable rotor noise, the relatively low workload required to trim and maneuver the helicopter, and the large reduction in vibration compared to either of our current production helicopters. Stability and trimmability characteristics are best measured qualitatively by the pilot effort required to perform a specific task.

At trim speeds from hover to V_H, the pilots estimated that pitch and roll control inputs were less than +0.25 inch with a very low input frequency. Directional and longitudinal stability, with SAS off, were significantly improved and qualitatively judged to satisfy the objectives. Maneuverability, as a measure of aircraft stability and pilot confidence, was self-evident when banked turns to 90 degrees were accomplished on the third forward flight.

Our test pilots qualitatively evaluate vibration on a scale similar to a Cooper rating which ranges numerically from 0 (very smooth) to 10 (extremely rough). An arbitrary division at the 5 level separates an "acceptable" vibration level from an "unacceptable" one. The objective of the 347 program is for pilot ratings 3 or above which would ensure favorable customer pilot reception of the vibration environment. Without absorbers on the initial flights the aircraft was acceptable from hover to 150 knots. Concurrent with the SAS and FPCS development, various configurations of vibration suppression devices were activated to investigate the reduction of vibration levels which can be achieved by this means. Figure 3

Figure 3



The Model 347 Helicopter

presents the data from a flight during which three cockpit absorbers were active. One of these operated in the lateral axis and two in the vertical axis. It can be seen that, although the absorber configuration is not yet finalized, the vibration levels being achieved have already reached the objective levels over much of the envelope. Subsequent testing with an additional vertical absorber has resulted in a further reduction at the heel slides and the vibration now meets the 4/rev objective up to V_{max}.

Figure 4 presents the external blade noise test data but does not tell the entire story with respect to the effect of noise levels on the opinions and efficiency of the flight crew. Historically, the blade "bang" and the high frequency "whine" of the transmission have been a source of pilot complaint and fatigue. It was especially heartening to

Above, the 347 in flight. Below, the 347's aft four-bladed rotor on the whirl tower

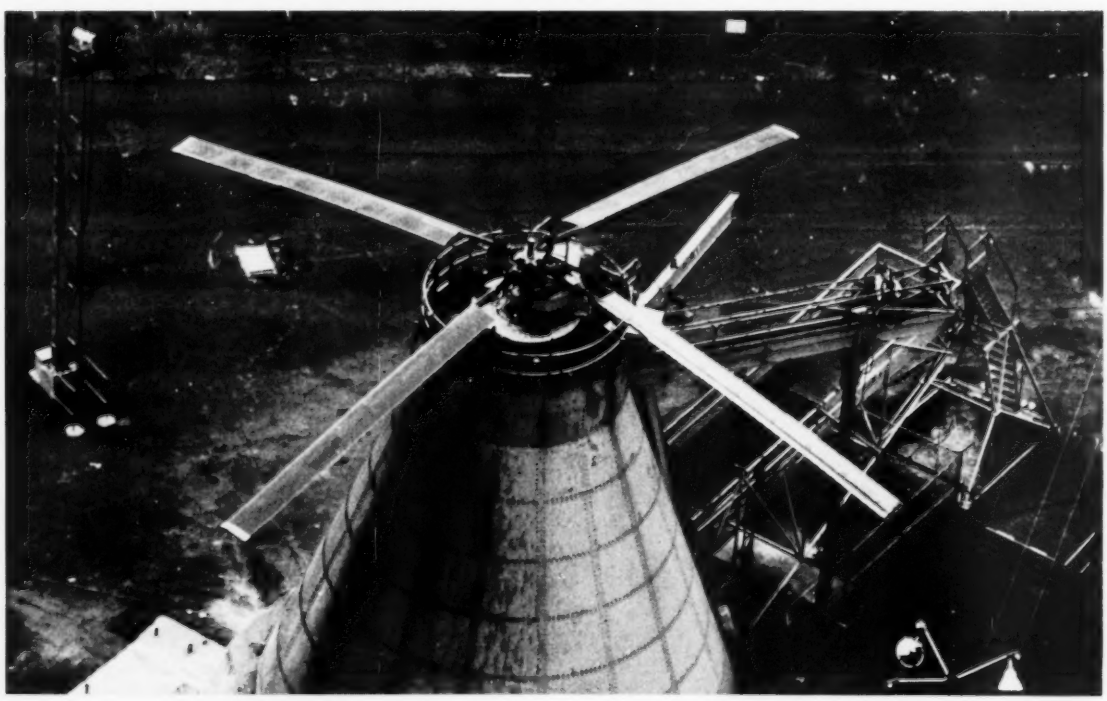
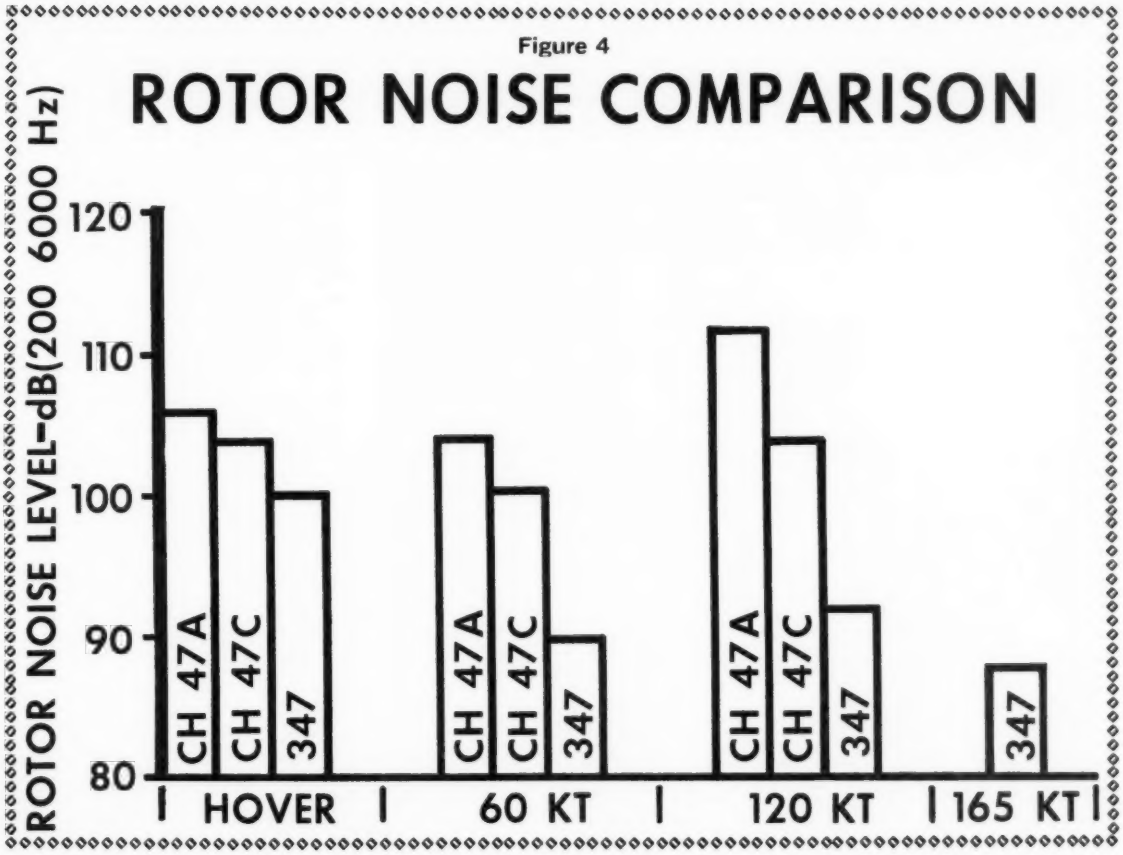


Figure 4



learn that blade "bang" was conspicuous only by its absence and that transmission generated noise was reduced to acceptable levels through the use of an acoustic bulkhead—a door between the cockpit and cabin — and extensive acoustic treatment around the cockpit enclosure. From this encouraging base line the program has moved on to the task of stability system optimization. The stability system is comprised of three subsystems: SAS (stability augmentation system), DASH (differential air speed hold) and AFPCS (automatic flight path control system).

The SAS and DASH are completely differential or "inner loop" systems in that their input to the rotor is not evident in any movement of the cockpit controls. Their purpose is to provide a high level of positive static and dynamic stability, and to hold the helicopter trimmed with respect to pitch and roll attitude, heading and air speed. In addition, the SAS uses sideslip inputs and roll-yaw coupled circuitry to provide a pedal fixed, "ball centered" turn capability.

The AFPCS uses "outer loop" or parallel inputs through the pilots' controls to maintain a specific flight path or altitude. The system is coupled to the navigation equipment and flight director inputs so that the aircraft can be flown automatically on the available modes of the FPCS mode select panel (figure 2).

Through the extensive use of decaded circuitry, the shaping parameters of the SAS, DASH and AFPCS are variable in flight, enabling the optimization process to progress with a minimum expenditure of flight time. To permit the stability system to be optimized with respect to both external disturbances and pilot in-the-loop maneuvering, control pickoffs are used so that SAS shaping is altered whenever the pilot makes control inputs. In this way the stability system provides a high level of damping without a compromise in maneuverability.

To date, the basic rate of damping and trim hold functions of the SAS have been completed and the aircraft will hold speed and attitude about any trim point

The Model 347 Helicopter

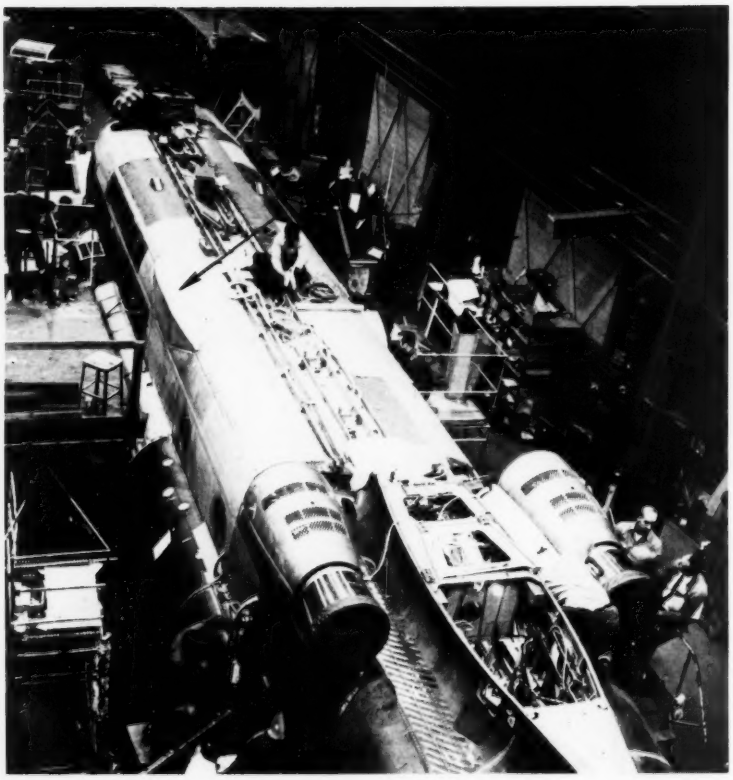


Figure 5

established by the pilot. The self-contained VOR, Doppler navigator, heading, homing, ILS and approach modes are currently being tested and will then be integrated into the AFPCS, providing a command cue through the flight director system. This command can be satisfied manually by the pilot or automatically by the autopilot. In the final configuration the pilot will have the capability to depart on a mission using a completely self-contained navigation system or via ground based NAVAIDS, monitor his position on computed present position coordinates and by map plotter, and automatically terminate to a hover either with a preprogramed approach or along a glide slope.

Winged Helicopter Phase

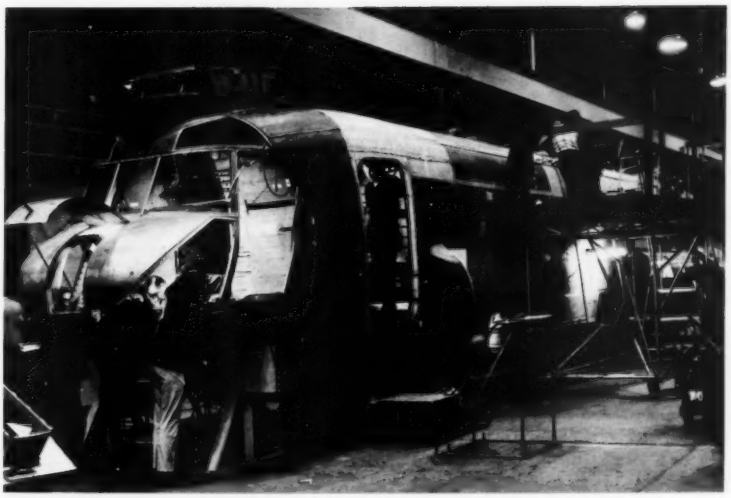
Following the demonstration of the pure helicopter, the aircraft will be removed from flight status for installation of the wing required for the phase II program. The purpose of this phase is to permit the evaluation of improved maneuverability, nap-of-the-earth flying and associated survivability which can be achieved through the use of a wing to unload the rotor system. The objective of the winged phase is to demonstrate a sustained 2 "g" capability at the gross weight of 45,000 pounds and a speed of 170 knots.

The wing mounting structure was installed during the original aircraft modification, and the fairing over the structure can be seen in the upper mid cabin in figures 1 and 5 (arrow). The wing will have a 45-foot span, 340-square-foot area and full span, 40 percent chord flaps. These flaps will operate automatically, with downward deflection proportional to the vertical acceleration experienced at the aircraft center of gravity during turns. In this way the automatic flap operation will effectively increase the lift-curve slope of the wing compared to a wing with retracted flaps. A CL_{max} of 1.8 can be achieved with 30-degree flap deflection so that the total lift required during a 60-degree turn can be achieved with less than two-thirds of the wing area that would be required from a plain unflapped wing.

To minimize the penalties associated with rotor download in hover and to provide the neces-

sary wing control in forward flight and in autorotation, the wing will be rotated to a leading edge up position (85 degrees from the horizontal) during hover and low speed, and automatically or manually rotated down to the conventional wing position in forward flight. Then, to ensure the correct balance between wing and rotor lift, the wing incidence will vary through a 23-degree range as a function of collective thrust lever position.

As the flight test program progresses, confidence is high that the program objectives will be achieved. The current schedule includes a demonstration period early in 1971 during which the Army will conduct a detailed evaluation of the aircraft and assess the various system developments relative to their military potential. The comprehensive avionics will provide both all-weather and extended VFR capability with minimum workload for the pilot, who will operate in a cockpit environment with vibration and noise levels well below current military specification requirements. The phase II program will demonstrate the effectiveness of a wing in providing improved maneuverability to meet or exceed the projected requirement of the Army.



Overall view of modification of demonstration aircraft

Continued from page 17

VIEWS FROM READERS

Sir:

As you probably realize, we in the Army ROTC program are rapidly entering an intensive publicity campaign to attract interest and participation in college-level Army ROTC. One of our concepts is to stress "Flight in the Army."

Request that this detachment be provided with any newspaper reproduceable pictures of Bell's HueyCobra and Lockheed's Cheyenne. These pictures would be used in publicity articles geared to advanced, sophisticated aircraft, with still the "seat-of-your-pants" flying sensation. Any pictures which would portray this effect, together with public releasable information, would be greatly appreciated.

LTC Norman R. Anderson
South Dakota State University
Brookings, South Dakota 57006

• Your request had been forwarded to the Office of the Chief of Information, Department of the Army, which is the established office for the release of public information and photographs concerning the Army.

☆ ☆ ☆

Sir:

Reference the picture of a mounted cavalry unit on page 26 of the June 1971 DIGEST in "We Armed the Helicopter."

The picture is identified as the 102d Cavalry Battalion. There was no 102d Cavalry Battalion. There was, however, a 102d Cavalry Regiment (H-Mecz) which was stationed at Ft. Jackson, South Carolina. This Regiment did participate in Carolina maneuvers in 1941.

At that date I was a Platoon Sergeant in Troop E.

LTC Padraig M. O'Dea
HQ 320th General Hospital
New York, N.Y. 10036

• Many thanks for the correction.

☆ ☆ ☆

Sir:

Your publication UNITED STATES ARMY AVIATION DIGEST has been extremely beneficial in our efforts to train primary jet students. The principles of aviation safety put forth by the DIGEST pertain to all aviation fields with application to fixed wing and rotor aircraft.

At the present time we only receive one copy per month. To satisfy student and instructor demand we would like to receive 10 copies per month. If this increase could be affected as soon as possible the beneficial effects would be felt immediately.

LCDR K. W. Fields
Naval Air Station
Meridian, Miss. 39301

• We are sorry that we cannot fill your request since distribution is not handled by the DIGEST's editorial office. Navy (and Marine Corps) personnel desiring to receive the DIGEST or increase distribution should submit requests to Director, Navy Publications and Printing Service, Building 157, Third Floor, Washington Navy Yard, Washington D. C. 20390.

☆ ☆ ☆

Sir:

About a year ago I read an article in the AVIATION DIGEST. The article I believe was in reference to the whereabouts of helicopter UH-1D 62-2107.

For the interest of your readers, Helicopter UH-1D 62-2107 is assigned to Army Medical Aviation Branch, Brooke Army Medical Center, Kelly Heliport, Ft. Sam Houston, Tex.

Enclosed is a picture of 62-2107 and a point of interest (as you can see) she is painted white now and still flying great, except a little trouble with her radios, as they are of the old family.

SFC Delbert M. Thomas
Maintenance NCOIC
Brooke Army Medical Center
Ft. Sam Houston, Tex. 78234

• Thanks for the photo of Huey 107 at left.

Sir:

In the past your magazine has published stories, told by the individuals involved, which brought home to the reader helpful, if not vital information and experience. A good pilot can learn not only from his own experience and error, but also from his fellow aviators.

My point is this: In every aircraft dash 10 there is a prescribed procedure for ditching. I have heard of Army aircraft being forced into this situation, but have never had an opportunity to get complete details, nor a personal "war story" to derive any information which may aid me in such an occasion. For my peace of mind, and doubtless many of my fellow swing-wings, I would humbly request your staff to give us some data and experience before it becomes necessary for one of us to go into the water without the benefit of another pilot's experience.

CPT Donald W. King
Commanding Officer
Avn Cavalry Troop,
14th Armored Cav
APO 09146

• Copies of articles printed on the subject are being forwarded.

☆ ☆ ☆

Sir:

"FOD Again!" from your July "Maintenance Matters" prompted me to send you some data on another FOD problem that difinitely is not peculiar to this command but is something that warrants worldwide attention. For the past few months we have been experiencing an unusual amount of "minor" FOD; minor being defined as repairable at direct support level as opposed to requiring engine replacement.

The cause has finally been isolated as being due to heads popping off rivets used in the assembly of the Filter Assembly, Top; P/N 205-060-254-27 (commonly referred to as the barrier filter). The loose rivet heads are then ingested by the engine. For a more professional rendition you might refer to figure 81, item 8 in TM 55-1520-210-34P-1. A DA Form 2028 was sent to U.S. Army Aviation Systems Command citing the problem and advocating the use of pro-seal as an interim measure to preclude further engine damage. The following is an extract of AVSCOM letter, file AMSAV-MEU, Subject DA Form 2028:

"This command is aware of the rivets popping off the filter frame assembly and a study of this deficiency is presently in progress. During this study it has been found, the manufacturer is using the right type of rivets for this application, but the wrong assembling procedures. That is, the rivets were installed improperly causing overstress to them, thus the popping off of the heads. The rivet heads would cause only minor FOD, and not require engine replacement. The manufacturer has been notified of this deficiency and is presently making changes to their assembling procedures.

"In the interim the following (Fix) procedure should be followed during the application of a sealing compound over the exposed rivet heads:

a. Using masking tape, mask off the area to be coated.

b. Remove the OD lacquer in the masked area using Scotchbrite and methyl ethyl keytone (MEK).

c. Wipe area with clean solvent.

d. Apply MIL-S-8802, pro-seal 890-B-2 material to the cleaned area. Ensure rivet heads are covered with a heavy coating of sealer and smooth area.

e. Allow sealer to cure as follows: air dry for forty-eight (48) hours or accelerate cure at 150° F. for 3 hours.

f. Remove masking tape and reinstall screen."

In practically all cases, AVSCOM's conclusion that only minor FOD would result has been correct; however, one engine (T53-L13A Serial Number LE22454) did sustain damage of a severity that required an engine change and the engine being returned for overhaul.

I hope that some of the above information will be useful in coming up with another squib for "Maintenance Matters."

MAJ R. F. Akin
Aircraft Maintenance Officer
16th Aviation Group
23d Infantry Division
APO San Francisco 96374

INSTRUMENT CORNER

Q. Can I maintain VFR-on-top if the flight visibility is 3 miles?

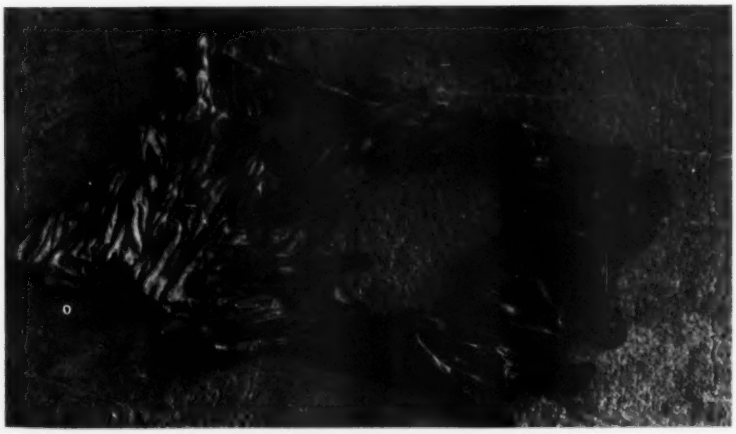
A. Yes and no. We have had several questions pertaining to exactly what are basic VFR minimums. The following chart was taken from Federal Aviation Regulations, volume VI, part 91, paragraph 91.105, effective 16 March 1968. We hope it answers several questions:

Altitude	Flight visibility	Distance from clouds
1,200 feet or less above the surface (regardless of MSL altitude)—		
Within controlled airspace	3 statute miles	500 feet below. 1,000 feet above. 2,000 feet horizontal.
Outside controlled airspace	1 statute mile except as provided in § 91.105(b).	Clear of clouds.
More than 1,200 feet above the surface but less than 10,000 feet MSL—		
Within controlled airspace	3 statute miles	500 feet below. 1,000 feet above. 2,000 feet horizontal.
Outside controlled airspace	1 statue mile	500 feet below. 1,000 feet above. 2,000 feet horizontal.
More than 1,200 feet above the surface and at or above 10,000 feet MSL.	5 statute miles	1,000 feet below. 1,000 feet above. 1 mile horizontal.

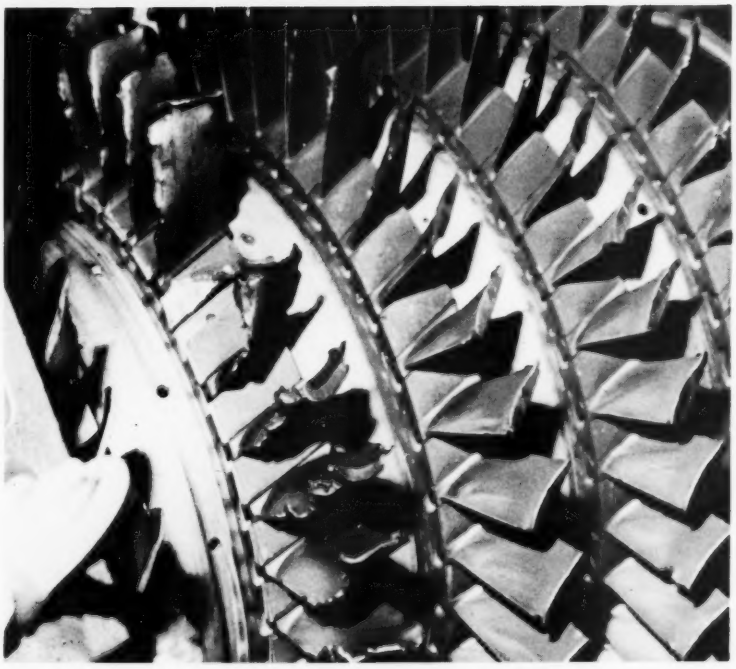
It is also stated in paragraph 91.105 that when the visiblility is less than 1 mile, a helicopter may be operated outside controlled airspace at 1,200 feet or less above the surface if operated at a speed that allows the pilot adequate opportunity to see any air traffic or other obstruction in time to avoid a collision. To operate within a control zone you must have a ceiling of at least 1,000 feet and at least 3 miles visibility. That is unless you obtain a special VFR clearance which is another subject. AR 95-2 also covers VFR operations on page 3-1.

the following 28 pages prepared by the U. S. Army Board for Aviation Accident Research

RAGGED



Rag left during maintenance . . .



. . . caused severe FOD and engine failure

MAINTENANCE

ACCIDENT: A UH-1H pilot made his preflight, start and runup. He received clearance, took off and called operations to tell them he was proceeding with his mission. He was told that a daily engine recording (DER) check was to be performed and started a climb to 1,000 feet. At 300 feet AGL and 60 knots, a grinding noise started in the vicinity of the engine and the engine chip detector and oil pressure warning lights came on. The needles split and the N_1 was seen passing through 50 percent. The pilot said his EGT was approximately 530 to 540 degrees C. at that time.

He started an autorotation and made a Mayday call. On short final, at approximately 15 to 20 feet, he saw concertina wire across his intended landing area and pulled pitch to extend his glide. He later stated he felt a definite drop in rotor rpm at that time. The UH-1H yawed left and impacted with skids level. The landing area was a small field. The helicopter rolled right at impact. The main rotor struck the ground and the helicopter came to rest on its right side.

After the accident, the crew stated they heard possible gunfire prior to engine failure and after they escaped the wreckage. They were picked up by another helicopter less than 5 minutes after the crash. Their only injuries were minor cuts to the pilot's arms and legs and the crew chief had a back sprain.

Investigation: No evidence of combat damage was found. Records revealed the UH-1H had a No. 1 intermediate inspection 6 days before the accident. The night before the accident, a No. 2 intermediate inspection was pulled with no major problems found. FOD checks were made as part of the daily inspections, with no foreign objects found. Both of the intermediate inspections were made at an LZ with limited maintenance facilities.

The copilot was a foreign national undergoing tactical training and he was unable to give the pilot much help during the emergency because of the language barrier and the short time involved. The pilot let the collective go after starting the autorotation to hold the cyclic and switch his radio to guard transmit. This action could have allowed the collective to creep up and cause a drop in rotor rpm.

Findings: A 14 by 20 inch rag lodged against the inlet guide vanes on the lower right side of the engine and caused engine failure.

Crew error was involved because the aircraft commander allowed the rotor rpm to bleed off to a point where it was inadequate for a successful landing.

Maintenance supervision was a suspected factor because the DER check 6 days prior to the crash indicated a potential engine problem and the helicopter was allowed to continue flight without an inspection.

Recommendations:

1. Unit maintenance officers monitor DER checks on a daily basis. For aircraft stationed away from the unit base area, an officer at each location should be in charge of daily monitoring.
2. Aircraft commanders be responsible for daily FOD checks. Flashlights are needed for checking engine inlets, even during daylight hours.
3. All unit aviators be thoroughly briefed and fully understand the purpose of DER checks.
4. A record be kept in the aircraft log book with daily DER checks listed from the past PE inspection.
5. In situations where emergencies occur at low altitudes, the aircraft commander should be mainly concerned with control and not radio calls. The board also recommended that emphasis be placed on copilot responsibilities to include changing radio frequencies and making calls during emergencies.
6. When maintenance is performed during darkness, extreme caution should be used in placing tools and rags. The aircraft should be checked thoroughly for FOD with flashlights after completion of any work.

A HERD OF CATTLE AND AN ELK

OH-23D PILOT: "My flight was to obtain annual minimums. My passenger had talked to me earlier about looking at some camp sites and pointed out the areas he wanted to see. They were near a lake and mountain. Prior to takeoff, I performed a thorough preflight. The only abnormality I noticed during preflight was some oil on the right deck and tail boom.

"We took off and flew west along a highway, flying east of the mountain, and encountered strong winds, so I decided to turn back and fly around the south side of the mountain. After looking at some camp sites, we flew east toward the lake. Enroute, we saw a herd of cattle and an elk.

"I started a left turn to take a better look at the herd of cattle. My altitude was 2,200 feet indicated. After turning about 90 degrees, I saw the rpm was 3000 and my altitude was 2,100 feet. I increased throttle and pulled pitch, with no response. The helicopter began to slow down and I started a turn at 50 knots. At 40 knots, I entered autorotation by reducing collective and rolling off throttle. The helicopter did not seem to respond to control movements. We were over trees and I headed for an open area. The helicopter continued to turn, or spin left, until we were about 60 to 100 feet. I got it straightened out, but it sank very fast. I started flaring and pulled pitch near touchdown. The OH-23 rolled to the right after touching down and the engine sounded as if it had stopped. . . . "

Questions asked pilot:

"What kind of turn did you make?"

"Medium to wide; not sharp at all."

"Did you check the air speed when you first noticed trouble?"

"Yes. It was about 40 knots."

"When you saw the rpm was low, what did you do?"

"Rolled on full throttle and pulled 2 to 3 inches of pitch. There was no increase in rpm."

"Did you check any other instruments?"

"Only the altimeter and tachometer."

"Did you bottom pitch?"

"Yes, and rolled off throttle."

"What was your rotor rpm after going into autorotation?"

"I didn't notice because I saw the trees and wanted to get to an opening."

"Did the helicopter spin or turn during autorotation?"

"About one complete revolution."

"What attitude were you in when you hit?"

"Slightly nose low, falling fast, and going straight. It hit left skid first, then rolled over to the right."

"Did you look out at any time during the turn?"

"Yes, momentarily. Then I looked back into the cockpit and saw the low rpm and air speed."

"How many OH-23 hours have you flown?"

"Fourteen to 16."

"Did you roll the throttle on after going into autorotation to see if the engine would respond?"

"No. The helicopter felt odd."

"Did the helicopter perform well before your accident?"

"Yes, it had plenty of power."

Analysis: "While the pilot was technically qualified in the OH-23, he was not fully capable or ready to perform a reconnaissance mission. After identifying the herd of animals he started a left turn to watch them. He apparently had to shake his head toward the cattle several times before the passenger saw them. After approximately 90 degrees of turn, he returned his attention to the cockpit and saw that his altitude was 2,100 feet, air speed 40 knots and engine rpm 3000. He incorrectly analyzed this as an emergency and applied full throttle and up collective. . . ."

Flight Surgeon: ". . . It can be conjectured the pilot experienced spatial disorientation after he switched from looking at a herd of longhorns to his instruments. He believed he was coming in straight and level, but the left skid touched down first and the helicopter turned over."

Findings: The pilot misinterpreted an almost normal situation as an emergency and reacted improperly to the emergency he thought existed by pulling pitch in an attempt to regain rpm, autorotating, failing to apply sufficient right pedal, not checking engine power during the descent and not turning into the wind. He allowed himself to be distracted by the cattle and did not realize his left turn was downwind, requiring more power to maintain altitude.

SFC Lawrence A. Hart
Aircraft Accident Analysis & Investigation Department
USABAAR

FLY NOW--MAINTENANCE LATER

THE EARLY MORNING fog was dense, with a light drizzle. An O-1 pilot was told to perform a resupply mission, regardless of what else he did that day. Because of the weather and required maintenance, the crew chief did not have the airplane ready for flight. About midmorning, the pilot sarcastically asked the crew chief why the airplane wasn't ready. The crew chief replied that he had worked until midnight the night before and couldn't keep up with all the required maintenance. He was supposed to maintain four aircraft of three different types. The pilot said he wasn't concerned with the crew chief's personal problems and told him he wanted the airplane ready for flight.

The pilot had flown three times the regular hours over the past two days and was taking medicine. As the weather cleared shortly after noon, he decided to take off. He again asked the crew chief if the airplane was ready and the crew chief replied that it still needed a lot of maintenance, including a starter lead and oil pump. The pilot said, "That's all right. I'll take it as it is. Button it up."

The mission was to make a food parcel drop to a jungle pinnacle. The pilot made his first pass east to west into the wind at approximately 50 feet. The drop overshot the pinnacle by approximately 50 feet. He made two more passes, each with a little shorter circle. As he entered a left turn on the last pass, the O-1 stalled and made a sharp left turn in a nose down attitude. It crashed in trees a few hundred feet below the pinnacle.

The engine had stopped during the last pass. A check of the airplane's historical records revealed the engine had a history of low oil pressure. Indications were that it had a defective oil pump. Maintenance personnel stated the engine oil pump had even been primed to obtain enough oil pressure for starting. This practice had been approved by the maintenance officer. It's too bad the result of an oil sample taken a few days prior to the crash, with a reading of 750, was not received by the unit until a couple of days after the crash.

In view of these maintenance procedures, two of the other three aircraft were inspected. The first had a history of downgraded red X conditions. The records contained such items as a mag drop of over 200, a low reading on the vacuum gauge, flaps out of adjustment and rough running engine. All had been downgraded in order to use the aircraft. The other was a helicopter. It was supposed to be flyable, but had several red X conditions, two of which should not have been cleared for even a one-time flight, much less allow it to be flyable.

This type of maintenance comes from an attitude sometimes described as "fly now—maintenance later." Our attitude should be "maintenance now—fly when completed."

PAINT SCHEMES

Could you provide information on currently authorized paint schemes designed to make aircraft more conspicuous?—LTC, aviation officer

High visibility markings for Army aircraft are described in TB 746-93-2, "Painting and Marking of Army Aircraft," June 1967, as changed 27 January 1970.

HELMETS

Would you please furnish the following information:

1. How should flight helmets be marked for conspicuousness?

2. If tape is used to mark helmets, is it available through normal supply channels?—Captain, company commander

Information concerning helmet marking is found in TM 10-8415-202-13, October 1970. The tape used for marking may be ordered through the purchasing and contracting office. Manufactured by the 3M Company, the tape order number is 3483.

BROKEN WING AWARD

I was recently presented the Broken Wing Award with certificate and pin. I need to know if the pin is authorized to be worn on the military uniform and, if so, where. If not, why is it presented?—Captain, aviator

The Broken Wing Award pin may be worn on civilian clothes only. According to chapter 7, AR 385-10, 17 February 1970, the Broken Wing Award will be in the form of a lapel pin. Paragraph 130, C 19, AR 672-5-1, authorizes pins for wear on civilian clothes only.

The Broken Wing Award is presented to military or civilian aviators who display extraordinary skill, judgment and technique in saving lives or aircraft during inflight emergencies.

AVIATION ACCIDENT PREVENTION FORUM

an interchange of ideas between readers and USABAAR on subjects of aviation accident prevention

Send your ideas, comments and recommendations to Director, USABAAR, ATTN: E&P Department

ATTITUDE INDICATOR

My question pertains to U-8F airplanes. Sometimes the pilot's electrically driven attitude indicator is known to precess or malfunction. Under these conditions, is it all right for pilots to use the vacuum driven attitude indicator on the copilot's instrument panel? Could you clarify paragraph 3-5d, AR 95-1, with regard to this question?—Lieutenant, aviator

Referenced paragraph, as changed 21 April 1970, states an aircraft must be equipped with a lighted and fully operational attitude indicator, among other instruments, for flight into IFR conditions. Further, the vacuum or electrical sources for the flight instruments must be fully operational. The key words in the regulation which pertain to this question are "fully operational."

USABAAR's position is that the electrically driven attitude indicator is part of the pilot's primary flight instrument group and should be fully operational for flights into known or forecast instrument conditions. Any malfunction of the pilot's attitude indicator should restrict the aircraft from IFR operations. A precessing attitude indicator could result in pilot disorientation that would only be aggravated by attempts to use or include the copilot's attitude indicator in the instrument cross check. The vacuum-driven attitude indicator, located on the copilot's panel, is considered only a STANDBY indicator, as described in the Operators Manual.

As deadly as Eve, Lucretia Borgia and all other infamous females is a dame called ...

Miss Management

TWO U-8F PILOTS preflighted and noted that both main tanks were filled to one inch below the filler caps. They took off, flew for 15 minutes and landed at an Air Force base to pick up a passenger. The number one engine was shut down during the passenger pickup. They took off again and arrived at an Army airfield at 0955. This entire portion of their flight was conducted on the main tanks. They left at 1330, climbed to 8,000 feet and switched the fuel selectors from main to auxiliary tanks after 10 minutes of flight. As they entered the traffic pattern at an Air Force base at 1430, the fuel selectors were switched back to the main tanks.

Again, the number one engine was shut down while their passenger was offloaded. The fuel selectors were checked on main positions and the booster pumps were on, with pressure showing on the gauges. The pilots took off at 1450 and, as they reached 300 feet, the airplane yawed left. The number one engine surged momentarily, then quit. They began to lose altitude and the pilot applied throttles to both engines, overboosting the number two engine by 3 inches for 2 or 3 seconds. He then switched the fuel selector to the auxiliary position, pulled the propeller lever to the detent positon—not to full feather—shut the number one throttle off and applied 45 inches at

3200 rpm to the number two engine.

The airplane regained altitude and began a straight shallow climb of 200 to 300 feet per minute. Heading east at approximately 900 feet, it began a shallow right turn and continued climbing to 1,300 feet. As they reached a southwesterly heading, the number two engine stopped abruptly, with no advance indication. The pilot switched the fuel selector to the auxiliary position and maneuvered to an open field. With flaps in the full down position and 90 to 100 knots air speed, the ariplane descended rapidly. The pilot avoided a tree, pulled back the propeller and throttle levers and landed wheels up.

The airplane contacted the ground on number one engine first, then traveled 24 yards before the number two engine contacted the ground. It bounced back into the air three times, skidded 36 yards and turned 85 degrees to the right, coming to rest 150 yards from the initial point of contact. A large amount of sheet metal damage to the center wing section resulted. All landing gear doors, both left flaps, the right inboard flap, all lower engine cowlings, one engine and the two propellers were damaged beyond repair. Damages to the center wing section consisted of numerous bends, buckling and cracked skin, formers and stiffeners. Both engine firewalls were buckled and cracked. The number one engine mount fittings were bent out of alignment. Formers and channels in the main landing gear well were buckled, cracked and bent. The right and left elevators had cracked skin and were bent on the top surfaces.

Analysis: ". . . No attempt was made to restart the number one engine because the pilot had been advised by a former unit maintenance officer that he could expect it to fail. Both aviators became so involved in their attempt to return to the Air Force base that neither considered fuel starvation as the cause of engine failure, nor the possibility that the number two engine might fail for the same reason. The propellers were not feathered at the time of the accident. . . ."

Flight surgeon: "In this investigation, I found two very experienced fixed wing aviators involved in an accident stemming mostly from human factors. There was no indication that these factors were induced by fatigue, mental stress or physical conditions. Both held current class II flight physicals without waivers. Involved mostly were considerations of supervision, training, attention to details of fuel management and the placement of the fuel control panel. This accident points up the importance of keeping accurate records of fuel consumption, time on various tanks and switching tanks at proper intervals. Strict adherence must be given preflight checks and more attention paid to instrument readings than to pilots' feelings. There must be renewed emphasis on emergency procedures, especially in thinking through situations to arrive at the proper causes of emergencies. This accident again shows how human errors, though seemingly small, may be compounded to result in needless damages."

Findings: "Both engines failed due to fuel starvation when the main tanks emptied, a condition resulting from improper fuel management.

"The U-8, unlike most other Army aircraft, is not equipped with fuel low level warning lights.

"The fuel selector/control panel is accessible only to the pilot in the left seat.

"Fuel quantity gauges are located in an awkward position, not in general view of the operators.

"The airplane was not refueled before the return flight.

"The pilot had been advised by the former unit aircraft maintenance officer that he did not trust the number one engine and, if either engine failed in flight, it certainly would be the number one

engine. The board believed this advance warning, although found to be without basis, probably prevented the pilot from attempting a restart and falsely assured him the number one engine had failed as predicted.

"Considering this to be a routine flight, both aviators had flown the same route on many similar missions, but they apparently failed to consider variations in fuel consumption between their different flights.

"Proper emergency procedures were not followed.

"Although a checklist was available, it was not used."

Recommendations:

"That fuel management be emphasized during all phases of training.

"That all U-8 aircraft be modified by installation of fuel low level warning lights.

"That all U-8 aircraft be modified by moving the fuel selector/control panel to a point where it will be accessible to both the pilot and copilot, or that fuel quantity gauges be relocated to the instrument panel.

"That emergency procedures be emphasized during all phases of training.

"That all aviators be required to plan and execute flights based on existing conditions rather than following routine habits.

"That aviators refuel at every opportunity commensurate with mission requirements.

Though the auxiliary fuel tanks of this U-8F held 120 gallons of fuel, both engines stopped due to fuel starvation and this accident resulted. While little damage is apparent in the photograph, this airplane was damaged extensively.

"That all aviators be required to use published checklists.

"That all aviators and maintenance personnel be cautioned against making unsupported statements about the probability of engine component failures, and against placing undue faith in such statements.

"That suspected engines/components be inspected at appropriate maintenance levels to determine serviceability."

Approving authority: "The findings are approved with the following exceptions:

"Improper management was the accident cause factor established by the accident investigation board. There is no information in the report to indicate that the location of the fuel selector/control panel and the fuel quantity gauges or absence of fuel low warning lights were probable or suspected cause factors.

"The fact that the airplane was not refueled before the return flight was not a probable cause factor because the auxiliary fuel tanks contained 120 gallons of fuel when the engines stopped.

"The statement that the pilot's attention may have been diverted from fuel management considerations due to the remarks of the former maintenance officer concerning the number one engine is not consistent with the fact that the pilot switched to the auxiliary fuel tanks upon a power loss in the number one engine and later, in the number two engine. This indicates the possibility of fuel starvation had occurred to him.

"Although TM 55-1510-210-10/5 states that takeoffs should be made on the main fuel tanks, it is common sense that a takeoff is never attempted on nearly empty fuel tanks. The U-8 is capable of taking off with the fuel selector on the auxiliary tanks. As a result of not checking the fuel quantity gauges, the pilot did not realize he was taking off with the fuel selector on tanks that were almost empty.

"The recommendations that all U-8 aircraft be modified by moving the fuel/selector panel to a point accessible to both the pilot and copilot, or to relocate the fuel quantity gauges to the instrument panel is considered inappropriate because it would require extensive modifications. Proper flight planning, proper fuel management and an accurate record of fuel consumption will ensure that aviators are aware of the fuel status and will prevent this type of accident.

"In summary, the pilots attempted a takeoff without knowing how much fuel they had and where they had it."

Aviation Accident Prevention Management Course For NCOs

AS OF JULY 1971, the United States Army Board for Aviation Accident Research (USABAAR) is conducting a one-week aviation safety course for enlisted aviation personnel. The course provides training in Army aviation safety management and includes accident investigation, reporting, and prevention. Classes are currently being conducted at Ft. Rucker, Ala., under the supervision of the Director, USABAAR.

This course is intended for personnel not previously trained in a formal aviation safety course and who are presently assigned, or anticipate assignment, to aviation safety positions. The program is open to all personnel in grades E6 through E9 (specialists included) in the 67 series and 71p MOS. Quotas have been allocated to each Army area in CONUS, National Guard Bureau, ARADCOM, AMC, USAPHS, USAAVNC, and Ft. Stewart/Hunter AAF.

This is the first training course offered by USABAAR to NCO's. Qualified individuals interested in attending this course should contact their local school officer. The class schedule for FY 1972 is as follows:

CLASS NO.	STARTING DATE	CLOSING DATE
72-1	26 July 1971	30 July 1971
72-2	23 August 1971	27 August 1971
72-3	27 September 1971	1 October 1971
72-4	1 November 1971	5 November 1971
72-5	29 November 1971	3 December 1971
72-6	24 January 1972	28 January 1972
72-7	28 February 1972	3 March 1972
72-8	27 March 1972	31 March 1972
72-9	24 April 1972	28 April 1972
72-10	22 May 1972	26 May 1972

Communication Gaps

CW2 Joseph T. Robbins
Data Center
USABAAR

MANY MISHAPS could have been avoided IF—*if* the crew had stayed in bed, *if* the aircraft had been grounded, *if* the operations officer had scheduled someone else, *if* there had not been a communication gap. This is the *if* I'd like to discuss.

Communication gaps have plagued mankind since the beginning of time and will continue to do so unless each individual becomes more aware of what causes and prevents communication gaps and cockpit misunderstandings. An accident that comes to mind is one in which the copilot prematurely raised the landing gear. It could not be positively determined if the pilot had given a command to raise the gear. However, there was a communication gap. Either the pilot did not *say* what he thought he *said*, or the copilot did not *hear* what he thought he *heard*.

The pilot assumed he had said, "Gear up." The copilot stated that he heard the pilot say, "OK, gear up." The aircraft accident investigation board stated that the copilot expected to hear the command to raise the landing gear and consequently reacted to whatever the pilot said. What he said could not be specifically determined, but was heard by the copilot to be, "OK, gear up."

The board suspected the fact that neither the pilot nor copilot were wearing helmets or headsets probably contributed to this accident. One of its recommendations was that the procedure for the copilot to raise the landing gear of this particular aircraft during takeoff should continue due to the awkward location of the landing gear on the copilot's side. The recommendation stated, however, that the copilot should make sure the airplane is airborne before raising the landing gear. It also recommended that both the pilot and copilot wear helmets or headsets during takeoffs and landings so their communication will be at its best through use of the intercom system.

In another recent accident, one of the contributing factors was a gap in radio communications which were inadequate because a combination of low and high VHF transceivers prevented optimum communications between aircraft. After a thorough review of the report, I wonder if this was the only communications problem encountered on this flight.

The reviewing official stated: "In future, flight leaders are being directed to fly in a position of the formation that will allow observation and control of each member of the flight." This statement was made as a result of one of the established cause factors—the flight commander's failure to adequately direct and control the actions of his individual flight leaders.

Statements by witnesses and members of the flight included: "I knew he had radio problems." (Sounds like the flight leader knew, but failed to take corrective action.) "I saw the wires that he hit about 1-2 miles before we reached them." (Isn't it a pity he didn't have some method of communication to inform *all* of the flight about the wires?)

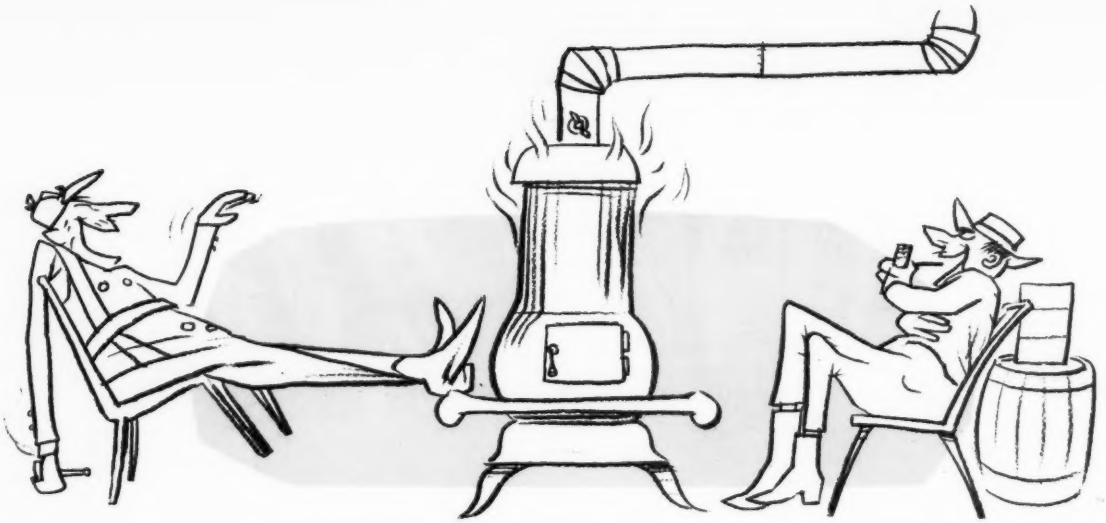
Have you noticed the attitude of shoulder-shrugging individuals who say, "We won't worry about it this time"? This was a young flight leader probably with an attitude of, "Oh well, whatever turns you on." Safety turns me on and should turn on *every* aviator in the United States Army.

Members of the flight stated they *assumed* they had permission to descend below the minimums published for this particular type mission. Have you ever examined the word *assume*? It's a perfect definition for communication gaps.

The cost of this accident was one expensively trained aviator and $35,590. Our files are filled with similar mishaps. We could probably pick out a dozen or more which occurred under similar circumstances, only with different people, times and places, due to communication gaps. It behooves all of us in aviation to improve our knowledge and practice in the art of communication.

Major Chester Goolrick

B'r'r'r'r'r Sense



BACK IN THE GOOD old days, sensible people made a point of staying indoors when the thermometer dropped below the freezing point. The only outdoorsmen who could be found going about their normal pursuits when the mercury fell through the bottom of the tube were Eskimo walrus hunters, U. S. postmen delivering Christmas packages, and assorted explorers floundering through the snow in search of the North Pole or Alaskan gold.

The Eskimos and postmen, poor souls, were making a living. They had learned to deal with the cold, as nasty as it could be.

More often than not, explorers who set out with a world of misplaced confidence, a team of dogs, some seal blubber, and several yards of polar bear fur never made it home. They failed to learn, until it was too late, what cold can do to a man who is not *fully* prepared to handle it.

In those happy times, every military leader worth a pair of tarnished epaulets was taught it was advisable to shut up shop when cold weather

They failed to learn, until it was too late . . .

rolled around. When the first frost appeared on the pumpkins and leaves began to change color, Lee and Grant went into winter quarters and stayed there until the robins came back in the spring. If they had not, if they had been foolish enough to try winter operations, their armies would have become so hopelessly bogged down with frostbite, fouled-up equipment, mud, and morale generally on a level with the thermometer the Civil War might still be going on.

As we are all aware, times have changed—whether for better or for worse depends on your point of view. The Antarctic, which formerly had

a population consisting entirely of penguins, is beginning to look like Main Street on Saturday night. Alaska, Greenland, the northern reaches of Canada and other out-of-the-way (and frigid) spots are in the midst of booms which would make a housing developer sigh with envy. People who formerly thought of ice as something nice to have handy when you wanted to construct a mint julep now are accustomed to using it for building material. And as for military operations—Lee and Grant didn't realize how well off they really were.

What has brought about this revolution?

A new breed of men?

Not on your life.

Stick the average chap outside in a snowbank clad only in a T-shirt when the temperatures are subzero and he will freeze stiff as a barber pole in a matter of minutes, the way people always have. What has made the North Pole one of the world's way stations and the top of Mount Everest almost overcrowded during the rush season are:

- An increased respect for the hazards of cold
- Knowledge of how to survive and work in extremes of cold
- The equipment to handle it

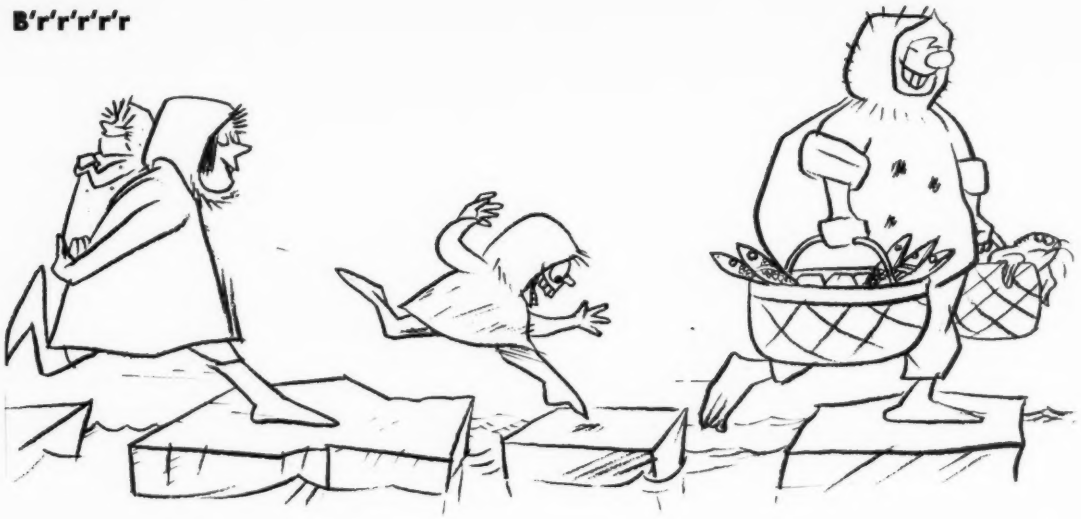
LOW—AND LOWER

Cold weather comes in about as many varieties as there are beans in a supermarket. Shove the thermometer a few degrees under zero on a crisp, dry day on Lake Winnebago, Wisconsin, and you have a situation which can actually be enjoyable provided you have the right kind of gear—and happen to like ice-boating. Elevate it a little and bring on a wet snow which gets down your neck and soaks through your socks and even Ukluk, the walrus hunter, heads for the igloo.

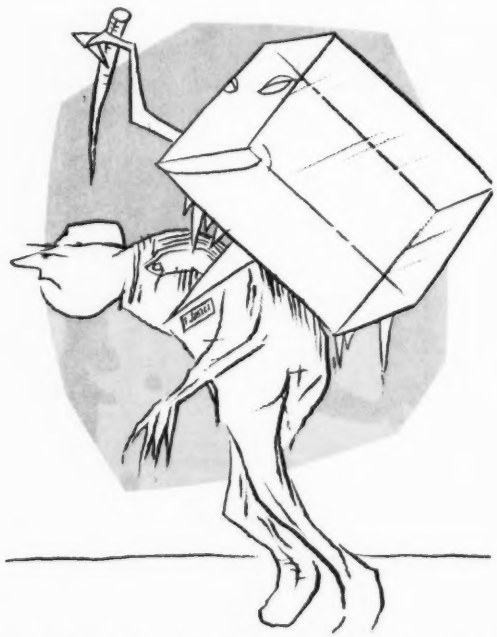
There is also the fact that what is one man's cup of tea is another's dish of plain poison. Weather which makes a resident of the Florida Everglades curl up with a case of the shivers will start Ukluk thinking about taking the family on an all-day picnic. Even so, temperatures ranging as low as 70 below, such as the aviation battalion assigned to Operation Great Bear had to live in and work in Canada a few years ago, can be the death of any living thing which ventures outdoors *without being forewarned and forearmed.*

Extreme cold of this sort is deadly and existence in it becomes a constant battle for survival under the best of conditions. But even moderate cold, the kind which tempts your Aunt Gertrude to drop her knitting and head for the ski slope, can take something out of you. Your ability to

B'r'r'r'r'r



live with it, to cope with it, and to do a useful job in it depends on your appreciation of the fact that any time you have to be out in any weather where the temperature is much under freezing you are up against a relentless adversary which works on the careless tenderfoot the way a slow leak drains fuel from a tank.



The cold first robs him of his will to survive, and then moves in for the kill . . .

COLDER AND COLDER WEATHER DEMANDS MORE AND MORE OF A MAN WHO HAS LESS AND LESS TO GIVE

If your physical system had a vote it would take sides with Lee and Grant. When it is subjected to bone-chilling temperatures, the body pulls in its defenses like an overmatched fighter covering up in the corner. The wheels don't turn over as fast. Metabolism—the rate at which you burn energy—is put on starvation rations. And the colder things get the more the machinery slows down.

A man in this condition can have a number of reactions. If it is cold enough, of course, and he isn't equipped to deal with the situation, eventually he freezes to death without even realizing what is happening to him. The cold first robs him of his will to survive and then moves in for a certain kill.

Happily, the number of Army aviators who have frozen to death recently is roughly the same as those who have been knocked down in the streets by hansom cabs. The number who have been *affected* by cold to some extent while on duty is far larger. Even under the best of conditions and with the best of equipment, cold weather will get under a man's skin if he stays out in it long enough. The least anyone can expect is fingers and toes so numb they feel as if they had been carved out of Vermont granite, and if things go on long enough he may have a couple of deep-frozen ears to deal with.

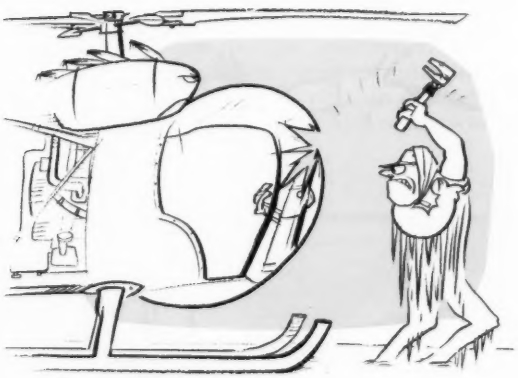
Nobody likes to be uncomfortable. Cold-induced discomfort, in particular, is not likely to

there is also the fact that what is one man's cup of tea is another's dish of plain poison

put a chap in the sunny frame of mind for which he is justly famous at the Lodge's annual shore dinner. A man trying to repair the innards of a Huey—or fly one—with fingers as stiff as a pair of $5 shoes will find himself using words not normally used around the best run Sunday Schools. If he doesn't watch himself, he may try to take it out on the Huey by belting it a time or two with a wrench. Or he may forget to torque a bolt properly or replace a cotter pin.

The physical discomfort doesn't stop at just making a man as irritable as a hive of hornets. The irritability is bad enough. Nobody who has a chronic cold-induced mad on—at himself, the machine he is trying to fix or fly, or his fellow workers—is likely to earn any special commendations for efficiency. Cap this state with boredom and torpor—a don't-care-if-school-keeps-or-not attitude on the part of a unit's personnel—and you have a situation in which all concerned would be a lot better off if they could hole in and hibernate for the winter, like bears and woodchucks.

Yet none of these attitudes is uncommon; in fact, all have to be consciously resisted by any group of men trying to do an expert job in the cold. And when anyone lets down his defenses he



If he doesn't watch himself, he may try to take it out on his aircraft . . .

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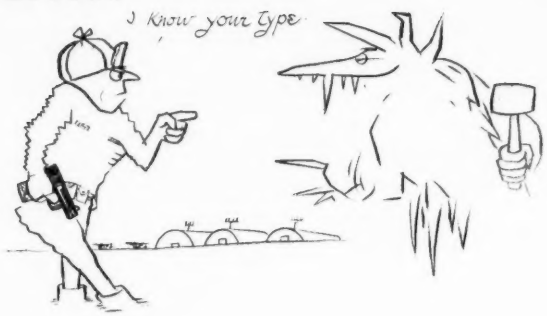


Cold weather wears more disguises than Mandrake the Magician

automatically becomes a ripe victim for another assault the cold can mount from still another direction.

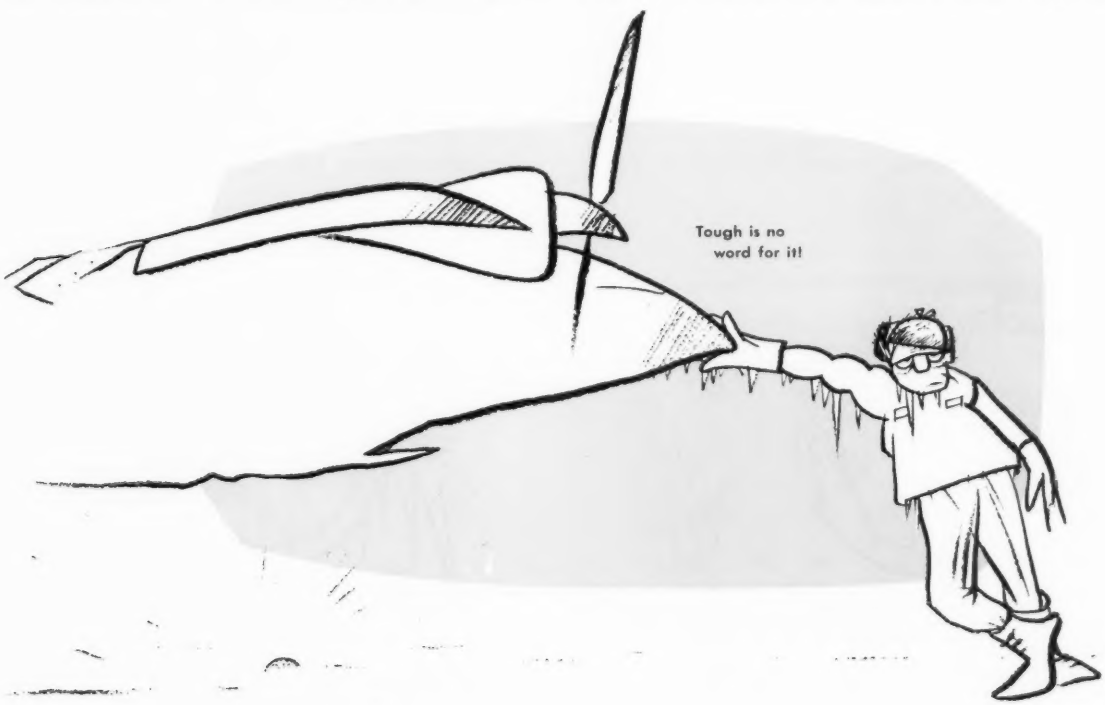
NOW YOU SEE IT , NOW YOU . . .

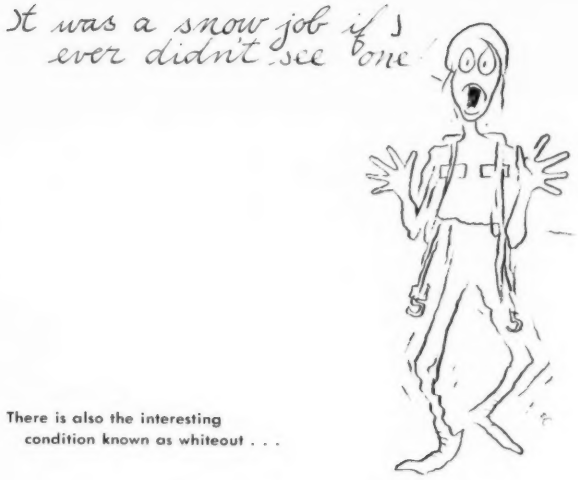
Extreme cold weather wears more disguises then Mandrake the Magician and is equally adept at pulling rabbits out of silk toppers, or at deceiving the yokels as to which shell the little pea is under. When the thermometer falls into the sub-zero class in the North Country and all the usual distractions—snow, ice, fog, sheet ice, and bone-bare landscapes—are added to the picture, you can be almost certain that nothing will be what it seems.

Things which appear to be only an enticing hoot-and-a-holler away, a stone's throw for a New York Mets outfielder, turn out to be a day's journey off by express dog sled. Perspective and depth perception are nonexistent. Horizons are about as difficult to determine as tomorrow's stock market ratings. Instruments can be trusted about as far as you would the stranger with the thin mustache and the beady eyes who asks you to join him in a friendly game of poker to while away the train journey.

Trying to do a job and do it well with cold-numbed hands and toes is bad enough. Battling confusion makes it worse. When you pause to consider the built-in evironmental hazards cold puts in the path of a beleagured person you begin to develop a not-so-pretty picture of how tough a proposition cold weather flying *really* is.

Take snow, for instance. It is indispensable for building snowmen and for rides in one hoss open sleighs. It looks splendid lying on the ground at Christmas. If you also give it half a chance it will obligingly cover an automobile graveyard, a swamp, or a field full of corn stalks to the point





There is also the interesting condition known as whiteout . . .

a list of what cold weather hazards are capable of would stretch from Ft. Rucker to Spitsbergen . . .

where they look as if they could accommodate a covey of Mohawks.

A sudden fall of snow can turn a pleasant VFR flight into a hairy IFR situation before a hapless pilot has time to begin thinking about a 180-degree turn. Rotor blades on hovering helicopters can stir up so much snow, men on the ground and pilots of other descending aircraft get the impression they are engaged in a reenactment of the Blizzard of '88. There is also the interesting—providing you are home reading about it and not trying to fly in it—condition known as the whiteout, a far-north atmospheric-surface phenomenon when light from snow on the ground and snow-laden clouds exactly match. Pilots encountering it have said later in shaky tones they felt as if they were trying to fly through a bottle of skim milk.

So snow, the small boy's best friend, is something else again for anyone in Army aviation who already feels as if he had been marked down for quick sale in the frozen foods department. Ice, fog, short hours of daylight, walruses on the runway—all the other nasty surprises cold can bring along in its bag of tricks—pitch in with enthusiasm to help make an aviator appreciate what the songwriter had in mind when he talked about summertime when the livin' is easy.

Maybe the point here is that you don't have to be an old hand with the experience of Admiral Perry to figure out that what the cold weather hazards are capable of would make a list which would stretch from Rucker to Spitsbergen. Nobody needs to be told that if you try to land an aircraft on an ice-coated strip you are in for a long, long rollout. (Some years ago a chap with an inquiring mind went out on a frozen lake to see how far he could drive a golf ball. It went 3½ miles.)

So that cold weather spells trouble is something everybody should grasp as easily as he does the concept that a person who dives off the top of the Empire State Building is in for a hard landing. Yet it is a matter of simple statistics that accidents resulting from some aspect of cold weather operations *do* take place and you can't always put it down to inexperience. More often than not, if you traced the dismal history of an accident to its beginning, you'd find that somebody—pilot, crewman, or maintenance man—was benumbed by cold to the point his wits got ice-jammed and he

. . . if you try to land an aircraft on an ice-coated strip you are in for a long, long rollout . . .

B'r'r'r'r'r

aircraft maintenance under any conditions, hot or cold, is hardly a task to be taken lightly . . .

goofed as he never would have in warmer times.

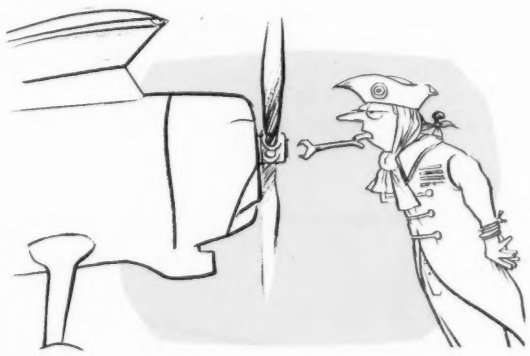
What, for instance, would you think of the pilot who lightened his load by removing his arctic survival kit to accommodate an extra passenger before taking off on a flight halfway across Greenland? Still wet behind the ears? Not a bit of it. It has been done, and by men every bit as bright and as experienced as the next boy in class. We will spare you the grisly details. This kind of cold-induced lunacy is extreme, but less apparent slips—such as a bolt improperly torqued by a mechanic standing ankle deep in slush—can be just as costly.

And, speaking of maintenance—

MAN'S BEST FRIEND

Aircraft aren't equipped to have fits of nerves caused by cold, but frigid weather can get to them just as much as it does to human beings. Any aircraft asked to operate in subzero temperature tends to become as cranky as a Missouri mule and twice as hard to handle. Servicing one is a test not only of a man's skill, but of all the patience and devotion he has at his command.

Aircraft maintenance under any conditions—hot, cold, lukewarm, rain or shine—is hardly a task to be taken lightly. At the heart of every mechanic's creed is the fact that the book must be followed every time and all the time, regardless. But right here is a nice, steel-jawed grizzly bear trap cold weather has waiting for the mechanic on an assignment in the cold country. *What constitutes the book at Savannah and points south doesn't always hold true in the Yukon.* To



Cold weather makes the mechanic's job tougher and as uncomfortable as Washington's men in 1776

A mechanic hooked by the cold can honestly think he has completed his work properly . . .

put it another way, the cold weather book always has several chapters nobody would ever have to learn if the Army would only follow Lee's and Grant's policies and shut down for the winter.

Deep cold which turns oil to the consistency of bubble gum, freezes tires to the runway, makes it impossible to touch metal with the bare hand, and coats every available surface with a thick layer of hoar frost, requires special techniques *in addition* to all the regular steps the maintenance book calls for. As if this were not enough, a cold weather mechanic's job is made tougher by his gloves and bulky clothing which make movement difficult and interfere with his sense of touch. And, no matter how well he is covered up, the cold will eventually penetrate his defenses, stiffening his fingers, bringing on a runny nose, and making him about as generally uncomfortable as Washington's men crossing the Delaware on Christmas in 1776.

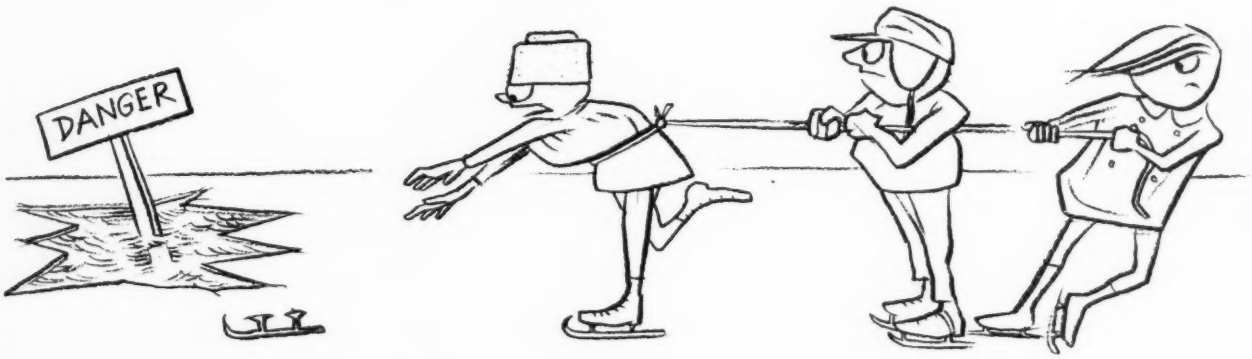
Unless he hasn't taken stock of the difficulties and what they can bring on, any mechanic working in the cold can lapse into a cold-induced attitude in which irritability is combined with boredom and indifference. His mind can foul things up by alternating between cursing the day he was born and wandering off into greener pastures, such as the centerfield bleachers in July. With his attention divided, a mechanic hooked by the cold can honestly think he has completed his work properly when actually he has omitted a step, fallen a victim to Murphy's Law, or left something only half done.

OUNCE OF PREVENTION

But leave us not think, gents, that mechanics are in a class by themselves when it comes to an allergy to cold. Nobody connected with Army aviation is immune and no amount of experience can allow a man to ignore what cold can do to him. *Anyone's* physical and mental processes can be slowed down by the cold and *everybody* must constantly bear in mind the fact that the weather has him under heavy attack.

But be of good cheer. Cold weather flying *is* being done and done successfully every day, by

Army aviation cold weather operations require constant vigilance on the part of all hands . . .



men who don't enjoy being frostbitten any more than you or I and who, given the opportunity, would just as soon shift the scene to Acapulco or even Death Valley.

To carry out their tasks, they have taken to heart a few simple cold weather laws:

- Beefing about the cold won't make it go away . Learn to live with it and get the job done.
- Don't rush. What takes an hour at Rucker takes two in the Far North.
- Be pessimistic. Expect the cold to do its worst. It will.
- Be consistent. Adopt the maintenance, flying, or operational procedure which is best for the particular area and mission and stick to it.
- Be prepared for the unexpected.
- Always take the extra step which amounts to a paid-up life insurance policy.

ONE MORE ROUND

The extra step? It is that all-important additional dollop of care and execution which any intelligent person puts into a critical and dangerous action as a simple means of keeping body and soul together. In Army aviation cold weather operations, it means that no detail is so unimportant as not to merit being gone over once and *then gone over again.* Simple flying or maintenance procedures which in warm weather require only *normal* action in cold weather must be approached with the sort of super-normal care Blondel, the high wire artist, uses when he sets out on a walk across the gorge at Niagara Falls. What is needed is the kind of constant, nose-to-the-grindstone vigilance on the part of all hands which would do credit to the chaps entrusted with the

Ice-clogged pitot tubes will instruct the altimeter to lie in its teeth to the pilot

task of seeing that Goldfinger never gets his paws on the nation's reserves at Fort Knox.

There's the preflight, for instance. To be recommended highly, all will agree. In cold weather, you will often need *two*, the second after the engines have been started and all systems activated to be sure ice-clogged pitot tubes aren't instructing the altimeter to lie in its teeth to the pilot.

Further, in cold weather nobody goes it alone. Work should always be checked on under any circumstances and every copilot should be sufficiently alert to tell if the pilot is coming down with a sudden attack of mumps. In cold weather conditions, the need for this super vigilance becomes an absolute must. Our canny forefathers on the frontier always doubled the guard at the blockhouse when word came that the tribe down the trail was drinking firewater and laying in a new stock of scalping knives. When cold weather is abroad on the warpath, Army aviation defenses are tightened so that nothing checkable isn't checked and nothing foreseeable isn't foreseen.

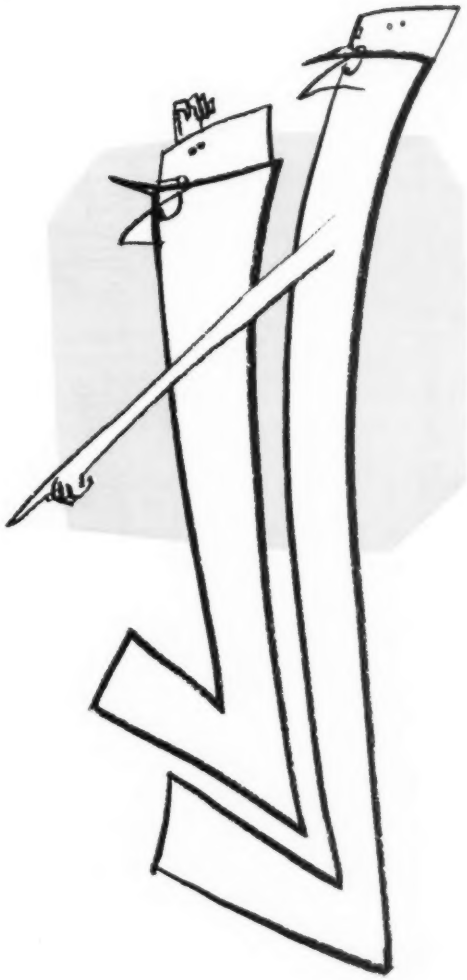
MAN WITH A MISSION

As far as actual flying is concerned, the best way to put it is that what is the simplest kind of operation at Fort Rucker in July can turn into a rousing nightmare which taxes every bit of a pilot's skill in cold weather. To put it another way, an aviator in cold weather nearly always has an overload of at least three things on his mental circuits in any given moment on a *normal* mission—

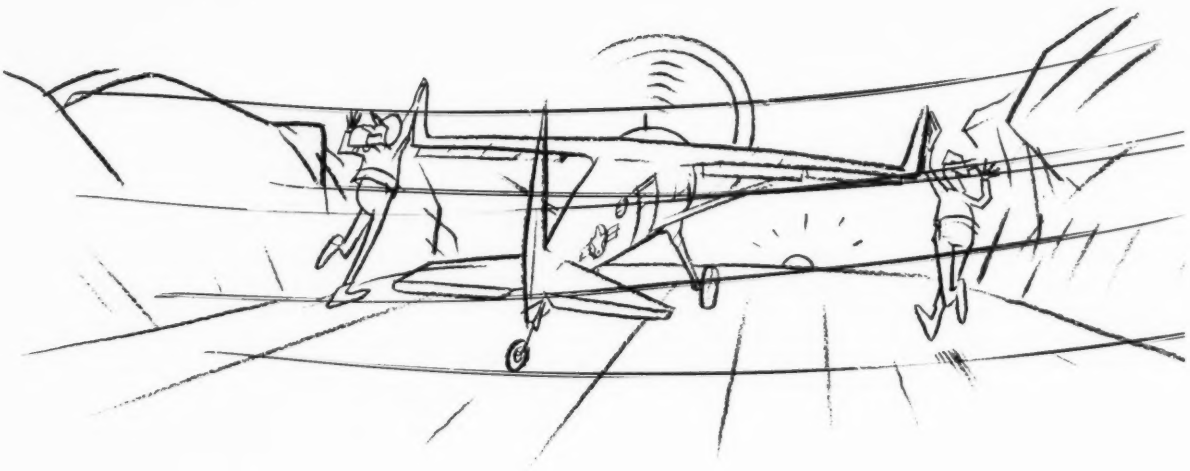
1. The ordinary job of flying the aircraft.
2. Taking care of cold weather-induced problems such as ice on the wings or blades.
3. Planning evasive action (Think Aheadness) to deal with conditions which can and probably will arise before he's safe back on the ground.

Just about every cold weather flight accident you could mention not directly caused by mechanical failure or a maintenance error can be laid at the door of a pilot who did a competent *routine* job of flying but who was dumped in the drifts by a special problem he had not anticipated. He had all the skill he needed. Where he lost out was in failing to appreciate the fact that cold demands the *extra* ounce of prevention, the *extra* margin in alertness, and foresight which makes the difference between successful and unsuccessful airmanship.

We might as well admit that it is wearying work, particularly when you consider that the man doing it may have already been worn down a degree below his peak by the cold. But it pays off. If you take the trouble to secure the services



In cold weather nobody goes it alone . . . work should always be doublechecked under any circumstance . . .



Secure the services of a team of trusty wingwalkers before taxiing on icy runways

of a team of trusty wingwalkers before taxiing on icy runways or ramps you avoid snagging a wing in a snowbank. A check of weather conditions upwind before takeoff may show you the warm air which can cause fog before you get to your destination. Fussy attention to cabin heat will prevent fogging your windshield during a crucial point of descent. Taking care to apply pitot heat can keep your air speed indicator from giving you a case of near heart failure by telling you your speed has dropped well below that of a respectable entry in a soap box derby.

As for *major* goofs such as we've already mentioned, such as leaving behind your survival kit, the pilot who pulled that one would probably be happy to tell you all about it in person if only anybody had ever been able to find him.

SMALL POTATOES

The extra attention to detail in all aspects of cold weather operations is one area where individual performance pays off like the jackpot in a silver dollar slot machine. Anyone who is a part of a large organization such as Army aviation, General Motors or a major league farm system can be forgiven if he sometimes thinks of himself as only an insignificant cog in a mighty machine, about as important in the overall scheme of things as a mouse in a barn full of owls.

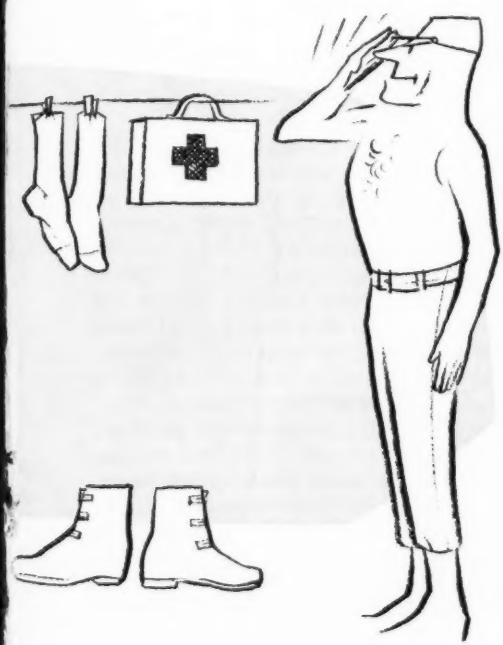
One of the bright things about the otherwise grey and overcast cold weather picture is that observation and experience can soon teach an intelligent man just how far off base such dismal notions are. Any day and every day, beginning when he puts on his clothes before going to work, he can see that what he personally does or does not do might have a telling effect on himself, his

unit and the entire operation before night falls and the northern lights appear.

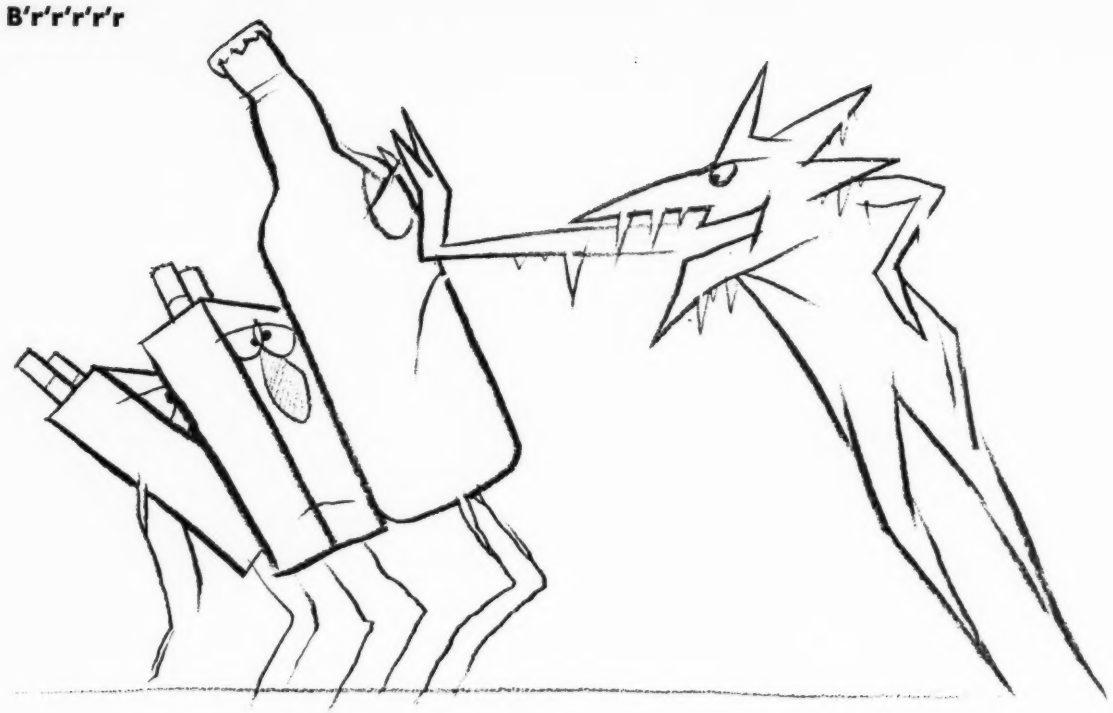
In cold weather, the correct use of personal gear—including clothes—becomes all-important. As one old hand once observed, every pilot should take off on even a short northern flight as if he expected to have to walk back. The correct fit of shoes, socks, and gloves makes the difference between relative comfort for the man on the flight line and frostbitten fingers and toes.

Speaking of frostbite, *personal* knowledge of emergency techniques and treatments of cold-caused disabilities is another important area in which the small cog plays a major part. Nobody wants the aviation unit in the north to turn into a do-it-yourself medical battalion in which everybody goes around applying mustard plasters to cure cases of double pneumonia, but there will be times when correct, knowledgeable treatment of frostbite can save an ear or a toe. The knowledgeable part is what counts. If you think you rub snow on a frozen ear you have a couple of thinks coming and it just goes to show there is more to coping with cold weather than putting on that red flannel scarf Grandma ran up for you on your last birthday.

Another thing the snowbound man finds out from painful experience if he isn't careful is the effect too many cigarettes or one beer too many can have on the human frame in weather ex-



In cold weather, the correct use of personal gear . . . including clothes . . . becomes all important. The correct fit of shoes, socks and gloves makes the difference between relative comfort and frostbitten fingers and toes



In cold weather, the effect of too many beers and too much smoking is doubled . . .

tremes. Nobody is at his tip-top best in any climate if he is a two-pack-a-day man or is suffering from a severe case of the whips and the jangles from staying too long at the party the night before. In cold weather, the effect is doubled. The man who is below par because of too much smoking, too many beers—or too much of anything—can be of about as much use to the team as a quarterback with a busted throwing arm. What is worse, he can be an actual menace by goofing off on some important task which can end by putting some other unfortunate (and innocent) soul down on an ice floe miles from home.

No machine, no matter how large, can afford a weak cog. *All* cogs are important. To be sure, a cog with a flaw can get by for a while when the machine is idling along. Put stress on it, go into high gear, and something gives way just when it is needed the most.

Cold weather puts just about all the stress on Army aviation's cogs they can take.

COOL, MAN, COOL

Any man handed the tough assignment of holding up his end of Army aviation in frigid weather has been automatically issued an additional ration of P's and Q's to mind. As if the normal hazards of aviation were not enough, he now finds he has a brand new set of problems, any one of which can be bone chilling in more ways than one.

The first job is to find out what the P's and Q's are. Some—not all, but some—can be discovered through homework, boning up ahead of time on what has already been found out at the expense of considerable sweat and many a hairy episode in such far-from-cozy lab experiments as Operations Great Bear and Deep Freeze. As any old hand who has done a tour in a winter wonderland will be glad to tell you at the drop of a fur parka, no one should ever go into a cold weather flying situation without sopping up every piece of information he can get in advance about the demands it will put on him and his job. They will also go on to say that he could study the situation longer than it takes to get a Ph.D. in quantum physics and still not be *fully* prepared for everything he can easily encounter in the course of one day's normal operations.

Discouraging? Not necessarily. It is on-the-job training, to be sure, and that is a situation in

which every job trainee, from insurance salesmen to apprentice pretzel-benders, can avoid stubbing their toes by:

- Following the book
- Proceeding cautiously
- Looking ahead
- Staying alert for the emergency

Cold weather hands you situations in which even your problems have problems. No one who fails to follow the four handy-dandy rules listed above and who isn't in top physical and mental condition will get by very long without running into something he'd never encounter in warmer climates—and which he will discover too late he cannot handle.

Above all, your veteran snowman never fights the cold. He takes it in stride, knowing the wrong attitude only makes things worse.

You might say it is one case in which you stay warm by playing things cool.

Follow the book and proceed cautiously

. . . no man should ever go into a cold weather flying situation without sopping up every bit of information he can get in advance . . .

OBESE GUNSHIP

Obese gunship lost rpm due to 600-pound overload

A UH-1C AIRCRAFT COMMANDER made a hover check with the engine rpm bleeding to 6400, then started his takeoff over a dirt road approximately 600 feet long. Before reaching translational lift, he pulled in power to clear two 6-foot posts protruding from the sides of the road. His engine rpm dropped to 6200. After clearing the posts, he reduced pitch to regain rpm and continued over the road for an additional 300 feet at an altitude of 4 to 6 feet. Unable to clear barriers at the end of the road, he turned left toward a clear area. The rpm dropped to 5800 and the helicopter landed hard in a barbed wire perimeter defense area in a tail low attitude. After initial impact, it slid approximately 3 feet and came to rest upright with the tail boom torn loose from the left side attaching points and the skids, cross tubes and gun system torn from the fuselage. The aricraft commander, pilot and gunner sustained minor injuries.

The maximum allowable gross weight was computed to be 8,600 pounds for existing conditions. It was found that the actual weight was in excess of 9,200 pounds, approximately 600 pounds over maximum allowable gross weight.

The investigation board stated that the aircraft commander demonstrated poor judgment in attempting to take off. The board further stated he demonstrated poor judgment when he elected to continue after the posts were cleared and the engine rpm had deteriorated. His left turn only created a need for more power, which was not available. Prior to this turn, the aircraft commander could have landed on the road with little or no damage.

The flight surgeon stated that the aircraft commander's SPH-5 helmet and pilot's SPH-4 helmet came off, although both chin straps were snapped in place. Both the aircraft commander and pilot had minor abrasions under their chins, probably caused by the chin straps.

The approving authority agreed with the board's findings and added a supervisory factor because the mission requirements exceeded aircraft operating limits.

Slippery Surface--
Low Tip Path Plane

CH-47C AIRCRAFT COMMANDER: ". . . During our approach, we had about a 400-foot ceiling and one-half to one mile visibility in light rain at night. The pilot, in the right seat, made the approach and we touched down facing along the eastern taxiway. I applied brakes, released the SAS and unlocked the swivels. The searchlight had been on during the approach and I scanned the row of revetments for a parking place. We taxied along the eastern taxiway which was very uneven and had several dips filled with water.

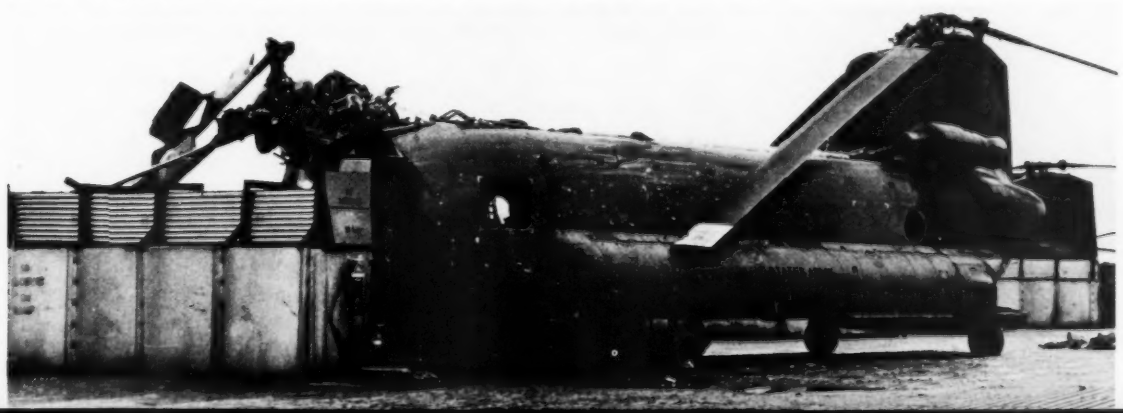
"After about 50 yards, the helicopter started to slide and we stopped. I put the speed trim in manual, advanced the forward trim about half way and we then started taxiing again. Reaching the revetment, I turned, facing into it, and stopped to post the ground guide. The pilot was operating the cyclic and thrust and blocking the pedals while I was using the brakes and power steering. After the fuselage was about one-third the way inside the revetment, we began to slide. We stopped and positioned the nose about 2 feet to the right of the center line. At this point, the pilot started to ease in power to move us on in. He was holding about one inch of aft cyclic and I remember looking at the blades, which appeared to be about 2 feet above the revetment.

"As we moved forward slightly, I saw a bright flash, apparently where the blades struck the left side of the revetment. We lurched to the right, slamming into the revetment, then to the left into the other wall, where we came to rest. The overhead panel had been pushed down by the forward transmission, tearing out all the wiring. When we pulled the condition levers and fire handles, nothing happened. We shut down the engines."

Analysis: The steel matting of the ramp was wet with rain. This, coupled with oil and hydraulic fluid on the matting within the revetment, made the ramp slick and taxiing difficult. The helicopter was being taxied with the speed trim in manual and the forward speed trim extended approximately half way, or to the 100- to 120-knot position. A test was made to determine where this would place the forward tip path plane with the cyclic centered and the stick positioned at zero. This showed the forward tip path plane would be 7 to 7.5 feet. The pilot was using one inch of aft cyclic to apply pressure to the aft gear, thus raising the plane to approximately 8 to 8.5 feet. The revetment height was 7.5 feet, with a 4-inch board across the top at 6-foot intervals, making the height at places 7.8 feet. It appeared the blades were barely clearing the revetment and any relaxing of the one inch aft cyclic or a wind gust could cause the blades to dip and strike the revetment.

The aircraft accident investigation board found the use of a non-standard taxi procedure, due to manually extending the cyclic speed trim while on the ground, caused the forward tip path plane to be unnecessarily low and strike the revetment. It listed probable or suspected factors as: The rough, uneven condition of the ramp, the rain which caused the steel matting to be slick and pilot fatigue due to the nature of the mission they had flown.

While a CH-47 pilot was taxiing on a wet, slick psp into a revetment, the helicopter slid and struck the revetment walls, resulting in major damage to the rotor blades; forward, aft and combining transmissions; engines; and other components



USAASO Sez

The U. S. Army Aeronautical Services Office discusses

Clearance definitions

Cruise Clearance: FAA Advisory Circular No. 90-54, effective 1 October 1971, redefines the term "cruise" in order to clarify the pilot's optional actions in relation to the Federal Aviation Regulations (FARs) and to assure mutual pilot/controller understanding. The gist of it is as follows:

Cruise—A word used in an ATC clearance (relating to an IFR flight plan) to indicate to a pilot that climb to and descent from the assigned altitude may be made at his discretion. Further, it is approval for the pilot to proceed to and make an approach at destination airport and can be used in conjunction with:

(1) An airport clearance limit at locations with an approved/prescribed instrument approach procedure (the FARs require that if an instrument letdown to an airport is necessary, the pilot shall make the letdown in accordance with an approved/prescribed instrument approach procedure for that airport) or—

(2) An airport clearance limit at locations that are within/below/outside controlled airspace and without an approved/prescribed instrument approach procedure. Such a clearance is NOT AUTHORIZATION for the pilot to descend under IFR conditions below aircraft in uncontrolled airspace. However, it does provide a means for the aircraft to proceed to destination airport, descend and land in accordance with applicable FARs governing VFR flight operations. Also, it provides search and rescue protection until such time as the IFR flight plan is closed.

Some specific examples of what a cruise clearance provides and what is expected of the pilot are as follows:

- For a flight that will be conducted solely within controlled airspace and the destination airport is served with a prescribed/approved instrument approach procedure, a clearance would read: "(aircraft ident) CLEARED TO (name of airport) VIA (route) CRUISE (altitude)." Air traffic control is advising the pilot to climb to and descent from assigned altitude can be made at pilot's discretion and that there is no other known IFR traffic between the assigned altitude and the applicable minimum enroute IFR altitude/minimum obstruction clearance altitude. It further authorizes the pilot to execute any prescribed/approved instrument approach procedure serving the destination airport, if necessary, and that the approach procedures associated airspace (including missed approach procedures) is free of any known IFR traffic.
- For a flight that will be conducted into an airport that could be within/below/outside controlled airspace but without a prescribed/approved instrument approach procedure, the clearance would read the same as in "a" above. The difference here is the fact that the airport does not have a prescribed/approved instrument approach procedure and that a portion of the flight may be conducted in uncontrolled airspace. The pilot would be expected to, upon arrival at destination airport, make descent below applicable minimum enroute IFR altitude/minimum obstruction clearance altitude and land in accordance with applicable Federal Aviation Regulations governing VFR operations. However, if IFR conditions existed upon arrival, the pilot would be expected to advise air traffic control and request further clearance.

Helicopter gunships are undisputed heroes of Army aviation, providing immediate and accurate firepower when and where it is needed most. Here is such a hero, the UH-1C.

Art by CW2 Chester Jezierski

Wear 'em Right

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